

AMSTRAD CPC464



After several years of development, the home computer has at last come of age with the introduction of AMSTRAD's personal colour computer - the CPC464. A thoroughly developed example of high technology that is colourful, friendly and complete. It is not possible to compare the CPC464 with other computers in its price range - since the CPC464 is the only one with a real typewriter style keyboard, 64K of RAM, 32K of ROM, a built-in cassette data recorder (the Datacorder), a screen display system and a very fast standard BASIC.

CONGRATULATIONS!

You're well on the way to discovering just why Amstrad's CPC464 system has been the most widely acclaimed home computer of all time.

No other system offers so many facilities, such power and potential for development at such a low price.

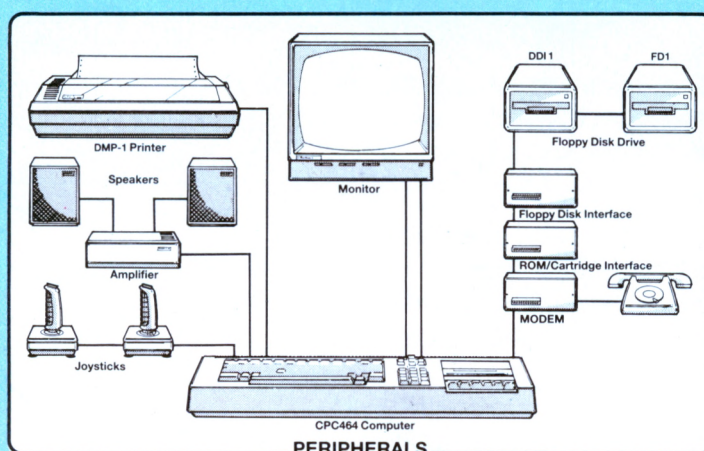
With Amstrad's long experience in consumer electronics, it's not surprising that within 6 months of the launch of the system, an independent survey of computer retailers (commissioned by another computer maker) discovered that although the Amstrad system includes a built-in cassette recorder and comes complete with either a green or colour monitor: the CPC464 system is **5 times more reliable** than a best selling computer that had already been on the market for 2 years!

This brochure is a compilation of the various sales leaflets covering the products available in the system, combined with some of the many enthusiastic reviews published in the computer press. So you'll see that our enthusiasm for the system is shared widely amongst the experts.

For up to the minute news, information on new peripherals and software, read the latest edition of AMSTRAD CPC464 User magazine - available at most good newsagents.

AMSTRAD CPC464 - the advanced family computer

The CPC464 is obviously much more than just a sophisticated video games console. With high resolution graphics and an 80 column text display combined with purpose designed companion screen systems, the CPC464 is the one low cost computer that provides the user with everything required to "plug in and get going" with applications for all the family, ranging from arcade games to business and accounting.



The CPC464 System

Advanced users will quickly appreciate the facilities for expansion:

specifically the built-in standard parallel printer interface; the low cost optional disc system which includes both CP/M*

(giving access to a library of over 3000 proven programs) and LOGO language (made famous in the

U.S.A. for educational programs and now being launched in the U.K.); and the virtually unlimited potential of the complete Z80 data bus with

"sideways ROM" support.

Beginners need have no fear of computing with the CPC464:

The CPC464 is packed complete with a Welcome tape to familiarise you with the computer and its capabilities; and a user guide that provides a beginners' tutorial section and a thorough introduction to the fundamentals of the hardware and software features that are specific to this computer.

The optional MP-1 power supply and modulator will enable the CPC464 to be connected to any home colour T.V. This unit is particularly useful to CPC464 owners who have chosen the Green VDU system and want

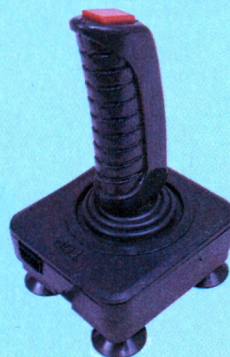
graphics displayed in colour. The MP-1 is compact and has been designed to match the styling of the CPC464.



A custom designed joystick (JY-1) is available as an optional extra to the CPC464. It

incorporates a comfortable contour grip with a fast response fire button and is secured by effective suction cup feet. The JY-1

is supplied with 150cm of connecting lead and a socket that accepts a second JY-1 joystick.



The strength of the CPC464 lies in the combination of powerful hardware and user-friendly software:-

Z80 CPU - The most widely used microprocessor found in home computers throughout the world, and with the best supported software base - especially since the CPC464 offers the option for the implementation of CP/M.*

64K RAM - The CPC464 is supplied with 64K RAM as standard, over 42K of which is actually available to the user, thanks to the implementation of ROM overlay techniques. This substantial usable RAM gives an indication to the sophistication and complexities in programming that are possible.

Graphics - The CPC464 supports three basic screen handling modes, including 80 column text a palette of 27 colours, and resolution up to 640 x 200 pixels.

Keyboard - A "real" 74 key colour coded keyboard with conventional 'qwerty' layout and largesize entry key. Cursor keys are sensibly positioned and a numerical keypad cluster is provided for convenient and fast entry of data.

Integral Cassette Recorder - Cassette storage is available as a built-in feature through the CPC464's integral datacorder. This provides program retrieval and storage with none of the inconvenience experienced with conventional units where compatibility, connecting and level setting often presents problems. Programs can be written at either 1k baud or 2k baud (speedload) with read speeds automatically established by software.

BASIC - An industry standard BASIC (written in the UK) is utilised in the CPC464. You will find it faster and more versatile than you have come to expect from such BASICs, with many extensions for graphics and sound, plus extensive support in firmware.

Extended Character Set - A full 8-bit character set including symbols and graphics is accessible via the keyboard and using the CHR\$(n) functions.

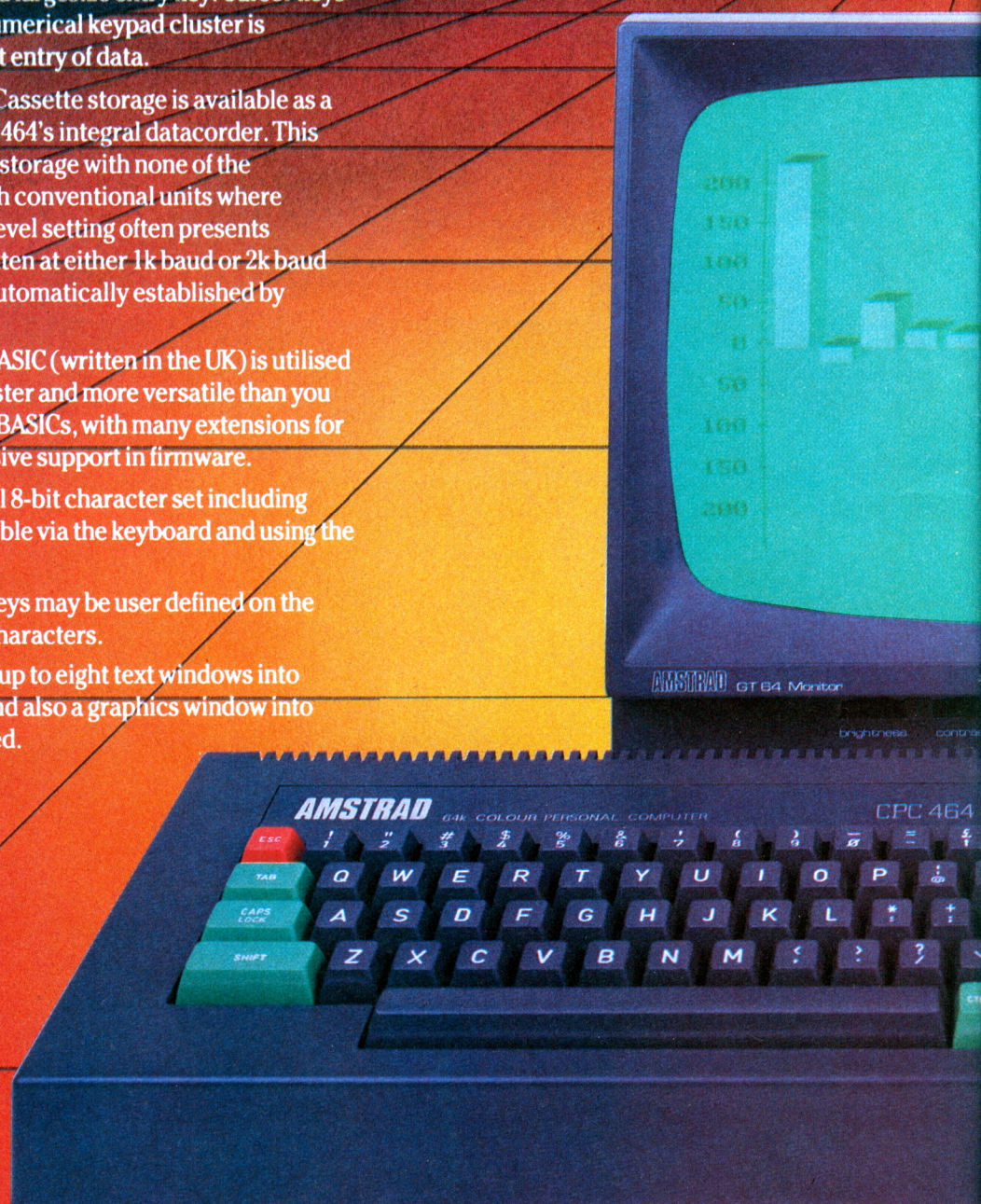
User Defined Keys - Up to 32 keys may be user defined on the CPC464, using strings up to 32 characters.

Windows - The user can select up to eight text windows into which characters are written, and also a graphics window into which plotting may be performed.

	January	February	March	April	May	June	1976
UK	5395.42	5793.81	5439.89	7415.35	6296.43	5182.39	33641.38
USA	3519.31	3546.81	3459.35	4594.90	3899.19	3899.19	23041.55
France	243.99	243.99	243.99	243.99	243.99	243.99	1461.95
Germany	233.87	233.87	233.87	233.87	233.87	233.87	1403.51
Spain	470.90	470.90	470.90	470.90	470.90	470.90	2825.40
Belgium	438.53	438.53	438.53	438.53	438.53	438.53	2631.09
Italy	584.23	584.23	584.23	584.23	584.23	584.23	3505.38
Holland	413.86	413.86	413.86	413.86	413.86	413.86	2483.16
Norway	5452.18	5452.18	5452.18	5452.18	5452.18	5452.18	32713.08
Sweden	555.82	555.82	555.82	555.82	555.82	555.82	3334.92
Denmark	1021.87	1021.87	1021.87	1021.87	1021.87	1021.87	6131.11
Canada	117.13	117.13	117.13	117.13	117.13	117.13	702.78
Japan	4271.19	4271.19	4271.19	4271.19	4271.19	4271.19	25627.11
Switzerland	262.45	262.45	262.45	262.45	262.45	262.45	1574.70
Korea	2776.50	2776.50	2776.50	2776.50	2776.50	2776.50	16659.30
Greece	589.26	589.26	589.26	589.26	589.26	589.26	3535.56
A. Euro	477.55	477.55	477.55	477.55	477.55	477.55	2865.30
TOTAL	30390.19	30390.22	30390.43	30390.43	30390.43	30390.43	182390.31

Spreadsheet - The CPC464 can make light work of financial accounting adding columns and rows with ease and at great speed.

Word Proc letters, memos can be typed, edited



AMSTRAD CPC464

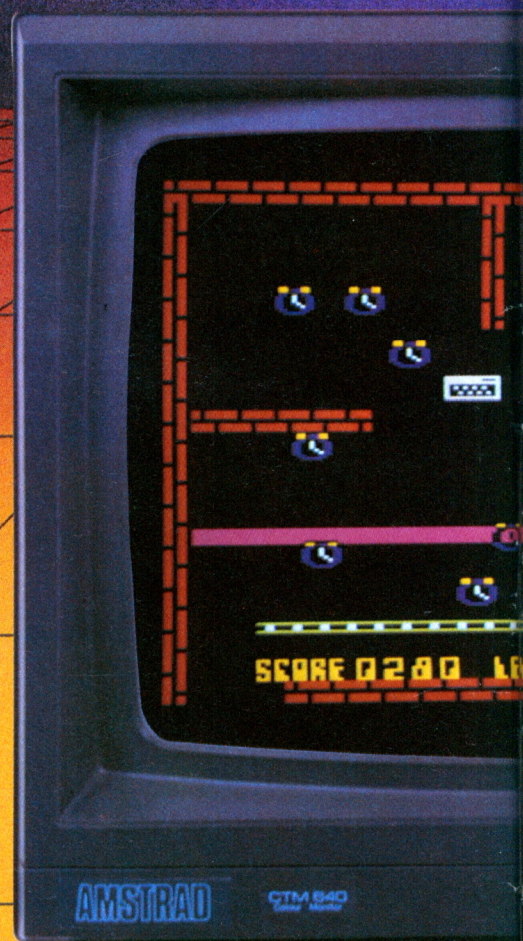
the complete computer...

With Colour Monitor CTM640

AMSTRAD's experience in colour TV production has evolved a compact and reliable colour monitor for use with the CPC464 system.

Only by connecting as directly as possible to the electronics that control the screen display can you get the best performance from the high resolution graphics and colour capabilities of the CPC464. The CTM640 drives each colour on the screen directly from the computer, with no unnecessary processing in the way to distort the view.

- ★ A complete system including RGB Colour Monitor or Green tube VDU
- ★ Built-in 'speed load' data recorder
- ★ 64K of RAM
- ★ "Real" 74 key typewriter-style keyboard with numeric keypad, user definable repeat characteristics.
- ★ 3 screen modes, 27 colours, user definable flashing rates.
- ★ High resolution providing 80 column text, 640 x 200 max pixel addressable graphics with up to eight text windows.
- ★ Joystick port supporting two joysticks.
- ★ Centronics compatible parallel printer port.
- ★ A complete expansion bus connector for sideways ROMs, serial interfaces, disc drives, modems.
- ★ Three voice, 8 octave, stereo channel output sound socket with volume and tone envelope shaping.
- ★ Comprehensive software support covering business and educational programs plus popular arcade games.



Not only do you get the best picture, you will have no problems like tuning a TV trying to get a steady picture - and no problems deciding who is going to watch TV programmes when someone else wants to use the computer.

The CTM640 uses all solid-state circuitry for reliability and fast warm-up with a bright display and crisp definition tube using the latest in-line electron gun technology. The convenient carry handle allows you to transport the system easily and safely - and the built in power supply for the computer keeps the number of interconnecting wires and mains lead cables to a thoughtful minimum - you have only one Mains lead to connect, which supplies the monitor, the computer and the cassette datacorder: compare that with alternatives!



Welcome to the CPC464 - every CPC464 comes supplied with a Welcome tape to demonstrate the versatility of the CPC464, and familiarise the beginner.



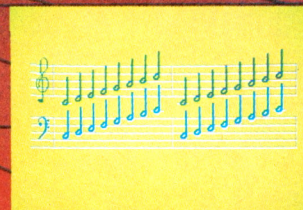
Wordhant not only encourages children to learn to spell, it's also fun for all the family as each tries to outwit the other with unusual words.



Test and improve your chess playing skills. The CPC464 is a formidable opponent but will also help you if you wish.



Business applications may incorporate three dimensional bar charts for graphically displaying key variables.



The musical potential of the CPC464 is quite breathtaking. Stereo sound and a 3-voice 8-octave range will bring the best out of any software.



Arcade entertainment galore!
There are now over 150 programs for the CPC464, and the number is growing every day.



AMSTRAD

CPC464

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Telex: 995417 AMSELE G

CPC464 TECHNICAL SPECIFICATION

LSI CHIPS:

Z80A processor running at 4MHz
64K bytes of RAM (over 42K available to user)
32K bytes of ROM containing BASIC and the operating system
6845 CRT controller device
GI sound generator chip AY-3-8912 3 voice, 8 octave
8255 parallel I/O device interface to the GI sound chip

DISPLAY SPECIFICATION:

Display Mode	Mode 1	Mode 2	Mode 0
No. of colours	4 from 27	2 from 27	16 from 27
Horizontal dots	320	640	160
Vertical dots	200	200	200
Horizontal characters	40	80	20

KEYBOARD:

74 keys - qwerty style, numeric cluster, cursor and copy cursor, large enter, shift, caps lock, tab, escape, delete, clear, control.

DATAORDER:

Write speed software selectable - 1K baud or 2K baud, read speed automatically established by software. Write protect interlock. Motor on/off controlled by software.

ADD-ON ABILITY:

Compact floppy disc drive system including CP/M* and LOGO language.
Centronics compatible printer.
Joystick(s).
Up to 255 additional 16K ROMs.

EXTERNAL SOCKETS:

PCB edge connectors for general purpose expansion and Centronics parallel printer.
9 Pin D-type socket for joystick
6 Pin DIN socket for
- RGB and sync
- composite video (luminance and sync)
3.5mm stereo socket for stereo sound output
5mm socket for CPC464 power supply (supplied exclusively from monitor)

DIMENSIONS (mm):

	w	h	d
Keyboard	580	70	170
CTM640	375	340	365
GT64	305	315	335
Joystick	90	170	100
Modulator	120	70	170

WEIGHTS (kg):

Keyboard	2.4
CTM640	10.6
GT64	6.3
Joystick	0.3
Modulator	1.4

POWER SUPPLY:

Screen System: 240V AC 50Hz
(keyboard and dataorder power supplied by screen system)

*CP/M is a registered trademark of Digital Research Inc. AMSTRAD and AMSOFT are trademarks of AMSTRAD Consumer Electronics PLC. In keeping with our policy of continually improving our service, and the technical quality of our products, we reserve the right to change component types, manufacturers, sources of supply or technical specification at any time.
Keyboard, Colour Monitor, Green VDU - Designed in U.K., Made in Korea
Joystick - Designed in U.K., Made in Taiwan
Power Supply/Modulator - Designed in U.K., Made in U.K.
Software - Written in U.K., Made in U.K.

AMSTRAD

DDI-1

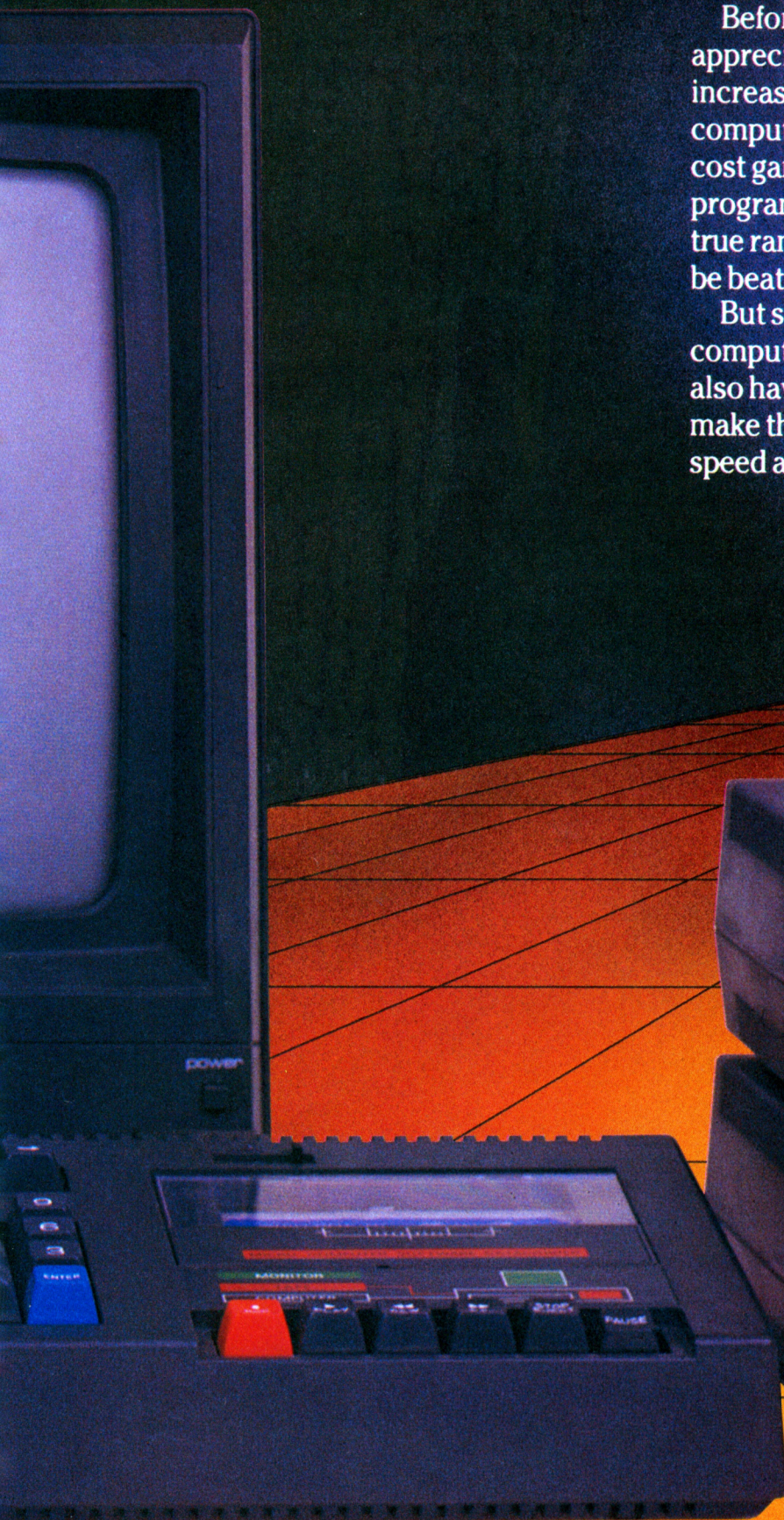
DISC DRIVE & INTERFACE
FOR THE CPC464



**A modern 3 inch disc
system, complete
with PSU, interface,
CP/M 2.2* and Dr
LOGO!**

Before long, any CPC464 owner will appreciate why disc drives are becoming increasingly popular with users who take their computing seriously. Cassettes are fine for low cost games - but for serious programs and programming, the power and convenience of a true random access CP/M disc system cannot be beaten.

But simply plugging a disc drive into a computer is no solution - the disc drive must also have the support of the right software to make the most of the dramatic increase in speed and storage capacity.



CP/M

Digital Research's famous Control Program/Monitor is the most popular disc operating system ever invented for 8-bit microcomputers. What this means is that assembly language programs written on one computer using CP/M may be transferred to another CP/M computer and run without major modification.

Dr. LOGO

Amstrad supply Dr. LOGO as part of the comprehensive software support package with the DDI-1. Digital Research have developed a version of the LOGO language specifically for the CPC464. It includes features such as the famous turtle graphics, procedures and recursion - incorporating the sound and graphics commands of the CPC464.



Amstrad's DDI-1 includes a complete series of extensions to the BASIC that allow the disc to use files originally created for cassette. The software also takes care of the necessary file management so that CP/M files can exist alongside these AMSDOS files. In fact, data files may even be shared between AMSDOS and CP/M.

The DDI-1 comes complete with an integral power supply, and a plug-in controller unit that locates securely onto the disc interface bus at the rear of the CPC464. A second disc drive unit may be added directly onto the socket already built into the cable from the interface (Amstrad FD-1) to double the on-line storage capacity and simplify copying files and producing safety back-up discs. A second interface is not required.



AMSTRAD

DMP 1



DOT MATRIX PRINTER FOR USE WITH CPC464

The DMP-1 is an ideal accessory for your CPC464 providing a permanent reference of all your program listings, printout of letters, invoices and anything else where a 'hard copy' result is required.

It is an 80 column dot-matrix printer using a standard parallel centronics interface that when combined with the CPC464 offers a low cost, high performance computerised text processing system.

Correct use of the tractor feed ensures automatic alignment of the paper.

AMSTRAD

DMP 1 DOT MATRIX PRINTER

TECHNICAL SPECIFICATION

Print Method:

Impact dot matrix, unidirectional on a 5 x 7 character matrix.

Character Code:

7 bit ASCII, plus graphics extensions providing any combination of 7 dots in a vertical column.

Character Pitch:

10 Cpi, 80 columns max width.

Graphics Pitch:

60 dots per inch, 480 dots max. width.

Line Spacing

6 lines per inch when printing characters feeding at 10 lines per second.
9 lines per inch when printing graphics feeding at 15 lines per second.

Copy capability:

One original (0.15mm max thickness) and one copy.

Paper width:

Between 4.5 and 10 inches.

Dimensions (mm):

315(d) x 447(w) x 114(h)

Weight (kg):

4.8

Power supply:

240V AC 50Hz

Made in Japan.

DOT MATRIX PRINTER

The DMP-1 is a precision made 80 column dot matrix printer that operates at a print speed of up to 50 characters per second. It comes *supplied with a connecting cable* and requires no additional interface to operate with the CPC464.

Although using the standard centronics 7-bit printer interface, the DMP-1 includes instruction extensions that have been customised specifically for the CPC464 that provide a dot-addressable graphics capability.

The DMP-1 provides no-fuss operation with simple to understand controls, a thorough instruction and programming manual and an easily changed ribbon cassette system. The self aligning tractor paper feed ensures reliable operation and is adjustable from 4.5 inches up to a maximum paper width of 10 inches.

The printer is one of a range of AMSTRAD accessories to the CPC 464 designed to help you get the most from your computer whether it be writing programs, listing files, printing reports, invoices or letters.

In keeping with our policy of continually improving our service and the technical quality of our products, we reserve the right to change component types, manufacturers, sources of supply or technical specification at any time.

For use with the Amstrad CPC 464

AMSTRAD CONSUMER ELECTRONICS PLC
BRENTWOOD HOUSE, 169 KING'S ROAD
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Tel: Brentwood (0277) 228888 Telex: 995417 AMSELE G

POPULAR Computing WEEKLY

29 November-5 December 1984

Addition

Hardware *Amstrad DDI-1 Disc Drive* **Price** -199.99. **Supplier** Amstrad Consumer Electronics.

With the launch of its DDI-1 disc drive unit for the CPC464 machine Amstrad is now offering the cheapest CP/M computer available; controversy may surround precisely how 'standard' the system is (it bears the Digital Research stamp, version 2.2), and some people may be overawed with the idea of such an operating system taking over their home computer.

Fortunately, though, you can view CP/M as "icing on the cake". The disc system comes in two parts,

enclosed discs. In operation the drive is both fast and quiet, with a good solid response when loading and ejecting. Connection to the interface

rear of the CPC 464. This arrangement is not particularly stable, (remember the ZX81 Ram pack wobble?), but gold-plated connectors are used. The interface itself contains a floppy disc controller chip (uPD765A) and a 16K 'sideways' Rom that occupies addresses &C000 to &FFFF. This puts it in competition with not only the screen Ram but also the Basic interpreter.

The CPC 464 runs the Rom with the lowest number as the foreground program. Basic is Number 1, while the disc operating system Rom is 7, so when the firmware sets up the system it initialises the DOS but returns control to



drive and interface. The disc drive itself is housed in a box that also contains a mains power supply; it is rather long, but nevertheless compact. The drive itself is of the 3inch Hitachi/Panasonic format, using fully

is achieved with a ribbon cable complete with a parallel connector for plugging in a second drive. Two disc units is the most that system can handle. The interface plugs onto the exposed edge connector at the

Basic.
By cutting a wire link inside the interface it is possible to make the DOS's Rom become number 0, which means the computer will power up in CP/M But I am getting ahead of myself - the first thing people do with their new

POPULAR Computing WEEKLY

disc drive will not be to delve inside and start hacking away at the circuit-board.

How does the system work in normal use?

It operates in two basic modes - Amsdos, the Amstrad disc operating system - and under CP/M.

When you first attach the disc drive and interface there is no immediately obvious change; the computer powers up in Basic. However, as soon as you use what would normally be a cassette command, it is the disc rather than the cassette that responds. Stream 9 has been re-routed and the firmware jump-blocks are overwritten during power-up.

Amsdos, as this level of operation is called, also adds a number of extension commands to Basic, provided by the resident systems extensions (RSX) and therefore preceded by a bar symbol. It is possible to select the default drive, erase and rename files, and switch back to cassette operation, either for reading, writing, or both. Issuing the commands |TAPE. IN and |DISC. OUT, for example, will result in a Load operation fetching a program from tape and a Save putting it on to disc. To provide the RSX calls and give Amsdos work-space, some Ram needs to be borrowed from the computer; it appears that just over 1K is lost to Basic. The extra routines associated with the DOS are vectored through Ram jump-blocks, and these are documented in an appendix to the firmware manual.

So far, very good. The disc drive provides a storage method about 50 times faster than cassettes, and automatically makes back-up files when files are closed (it renames the old file with a Bak suffix and deletes any other back-up). Each side of a disc's 40 tracks holds 180K, of which the directory occupies 2K.

With CP/M, however, 9K is lost to the system, and there are two other formats possible. Vendor format leaves space for CP/M information, to avoid you selling the property of Digital Research (who employ some very good lawyers!). IBM format allows discs produced on an IBM PC with CP/M 86 and 3inch disc drive to be read by the CPC 464 and vice-versa. This last option gives 154K capacity.

What delights await when the |CPM command is used? Assuming a system disc is in place, some data is loaded, the screen changes colour and the screen notifies that we are in CP/M. A Dir command will show that the system disc provides not only the 'standard' utility programs, such as ED, MovCPM, Pip, Asm and Ddt (these last are an 8080 assembler and de-bugger respectively) but a number of Amstrad additional commands such as Cload and CSave (tape/disc transfer), Disc-copy, SetUp and Amsdos.

There are two restrictions placed on any CP/M programs you might wish to run - other than the fact that they need to be on a 3inch disc. As the CPC 464 firmware uses all of the Z80's restarts but RST 6, this is the only restart that is available to CP/M. DDT, for example, normally uses RST 7: so the Amstrad version has to be patched to use 6. Other programs may also have to be patched to use RST6.

The other is the contentious matter of the size of the transient program area - how big a program can be run in Ram? Most CP/M systems allow about 56K for programs to use, but as 16K of the CPC 464's memory is used for screen display, it is not surprising that there is only 39.5K available to run programs in Ram. This is not as serious a drawback as it might seem - the whole point of CP/M is that portions of program and most of the data is held on disc and overlayed into Ram when required. Some programs will need to be altered, which, while not a layman's job, should not be a major task.

I have seen such items as Microsoft Basic and Wordstar running on the Amstrad without patching, but these both cost more than the computer so who would want to run them anyway?

Amsoft expect to provide a number of CP/M programs fully compatible and tested with the CPC464, at affordable prices. The first Examples will be Quest's ABC accounts package (£99 for the three basic modules, instead of a claimed £750 for other CP/M machines) and the Microscript/pen/s-pread word processing, database and spreadsheet programs at £50 each.

If you want anything else, Amsoft will put you in touch with a company that can 'port' across any CP/M program at retail prices - Timatic Systems of Newgate lane, Fareham, Hants.

What must not be forgotten is that, even without CP/M, the disc system for the Amstrad CPC 464 would still be a very worthwhile addition - add CP/M and you have much more than just icing on the cake.

Jeff Naylor

Reprinted from Popular Computing Weekly Vol. 3 No. 48 1984

AMSTRAD MP1

Colour modulator and power supply system

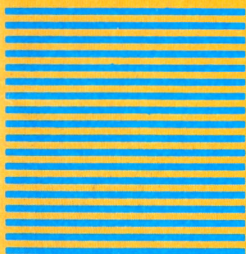
Owners of systems with green tube monitors can use their own colour TV to provide a colour display for games when used in conjunction with the MP1.



The MP1 also includes a 240v AC mains power supply to provide the DC voltage required by the CPC464, which is otherwise derived from the monitor.

Tune your UHF TV to channel 36 to receive the picture in full colour.

YOUR GUIDE TO LOW-COST HOME COMPUTERS, GAMES, ADD-ONS AND SOFTWARE



CHOICE

SEPT

1984

70p



VINCE CLARK: CHARTBOUND COMPUTERS



FOOTBALL GAMES: PUT YOUR MICRO IN ANOTHER LEAGUE

TWIN TEST: AMSTRAD V COMMODORE

ADD-ONS: PRINTERS FOR EVERYONE

Australia A\$ 2.00
Denmark DKr 25.00
Germany Dm 5.50
Greece Dra 170.00
Holland Dfl 6.00
New Zealand NZ\$ 2.65
Spain Pts 260.00
Singapore M\$ 3.80
U.S.A. \$ 2.50

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1984

ON TEST: AMSTRAD CPC464 AND COMM



TESTS



BEST known for their low-cost hi-fi equipment, British manufacturers Amstrad have ventured into home computing with the new CPC464 micro, launched this spring. We take a look at how it stacks up against the Commodore 64, well-established machine which has carved a very substantial place for itself in the home market.

GRAPHICS

Amstrad CPC464 ■■■■■■

Commodore 64 ■■■■

At the time of introduction, the Commodore 64's graphics capabilities looked good. It was the first popular machine to familiarise the public with sprite graphics, and the screen resolutions — 40 lines by 64 columns in text mode and 320 by 200 in high-resolution — are better than

adequate. Sixteen colours can be displayed in either mode, but in high-resolution mode each block of eight by eight pixels must conform to the same colour information, i.e. the same foreground and background data must be specified for the block — some careful program design is required here. A second hi-res mode is available in which the horizontal resolution is halved to 160, but each dot can be in of four colours, again programmed in 64 point blocks.

This doesn't sound too bad in theory, but in fact Commodore provide very few ways of manipulating the hi-res screen, and beginning programmers will probably be more inclined to use the sprite graphics. These are user-definable shapes which can be moved around the text screen. Up to eight sprites can be defined and manipulated at the same time, and the manual goes to great lengths to explain how, although it barely mentions high-resolution graphics.

The Amstrad, on the other hand, has no sprites, but the designers really have gone to town on the high-resolution front, using the new machine's big memory to advantage. Top resolution is comparable with the BBC microcomputer, a massive 640 horizontal by 200 down, programmable in two colours. In the multi-colour mode, 160 by 200, each point is individually programmable in one of 16 colours. Not only does this compare favourably with the Commodore's block colour system, but it is a unique capability for any low-cost micro to date. There is an intermediate mode too, 320 by 200, with a choice of four colours. The set of colours used can, in each case, be chosen from a total "palette" of 27.

I haven't mentioned the text screen, for the good reason that Amstrad have abolished it, all text output now being displayed on the graphics screen. It's about time someone did this, for the distinction only ever arose

through lack of memory, and leads to a notorious inflexibility and confusion in the minds of learners. Amstrad haven't neglected the hi-res programmer either, and the BASIC contains a fair range of plotting commands for the high resolution screen. The blending of high-resolution and text screens also means that text can be displayed as 25 lines of 80 columns, making word-processing a practical alternative. All text characters can be individually redefined by the user, giving another means of graphic manipulation. There are a number of other nice touches, for example the screen can be scrolled up/down and left/right, and the actual screen memory area is completely relocatable throughout memory.

The Amstrad comes with its own monitor. If you purchase the green-screen version, you will have to put up with a monochrome display unless you also buy an external UHF modulator, in which case you can use a



domestic colour TV. However, the highest resolution mode, like that on the BBC Micro, will not give an adequate picture on a TV, so you'd be well advised to think carefully before deciding which monitor to specify. Amstrad have no plans to sell the colour monitor separately, I hasten to add.

SOUND

Amstrad CPC464 ■■■■■■

Commodore 64 ■■■■

Both of these micros use much the same sound synthesiser chip, the three-voice General Instruments device which is fast becoming a standard for home micros. This chip allows you to specify envelope shapes for each of the three sound channels, and to mingle white noise with the output to give explosion, gunshot and other effects.

The significant difference lies in the ease with which you can control this chip, and the Amstrad scores by default. If you want to use sound from Commodore BASIC, you'll have to put up with a byzantine system of POKEing values into memory, a deeply tiresome procedure. On the other hand, not only do you have dedicated tone and envelope commands on the Amstrad, but in accordance with their multi-programming facility, any sound you specify can be put in a queue to wait for the last sound generated to be completed. Without this buffering, as Oric users will know well, any sound may be cut short by the next one along. This is a very powerful facility for a home micro and on top of this, the makers have very considerably provided a stereo jack outlet so that you can run the sound through your hi-fi. They've arranged for the channels to be separated, too, into right and left with the third voice somewhere in the middle.

KEYBOARD & CASING

Amstrad CPC464 ■■■■■■

Commodore 64 ■■■■

Wow! I thought the Oric Atmos keyboard was good until I saw the CPC464. The keyboard here is nothing short of lavish. There is a proper QWERTY layout — the keys have a good feel, and there's a nice big ENTER key, finished in blue in case you miss it. In addition, Amstrad have very professionally provided a numeric keypad, such as you usually only see on busi-

ness machines, and the cursor keys are arranged in a neat cross shape just above it.

The really spectacular thing is that the entire keyboard is 'soft'. This doesn't mean it melts under your fingertips, but that every single key is redefinable by you, and the numeric keypad keys can be used as function keys. Up to 32 single key functions can be implemented, which means that most important BASIC keywords can be entered in one key-stroke. The casing design is elegant without being fussy, and there is a built-in cassette deck to the right of the keyboard, a great idea which simplifies loading problems immensely.

The Commodore 64 is less spectacular in this sphere. It does, however, have a proper keyboard, with a pleasant feel to it, and there are four function keys provided to the right of the keyboard, so it's pretty adequate. Personally, I don't find it's blocky grey appearance particularly inviting, but this is perhaps not the most important thing about choosing a computer.

BASIC

Amstrad CPC464 ■■■■■■

Commodore 64 ■■

We've already touched on this subject briefly. Commodore BASIC is, in my opinion, pretty inadequate. It doesn't provide commands for high-res graphics, or sound generation. It really isn't big, the BASIC only occupying 8K of ROM with a further 8K of operating system commands. In effect it's about the minimum one could expect from a BASIC interpreter.

By contrast, Amstrad seem to have packed as much as they could into their interpreter, but then they've got 32K to play with. The result doesn't conform to Microsoft Extended standard, but I think it has a lot to offer. There are graphics commands, although I feel they are a bit limited, confined to relative and absolute line draws. The sound commands, already mentioned, are much more impressive.

There are plenty more goodies. Many system commands are built-in, such as automatic line numbering, program merging, and a renumber routine, the sort of things you normally have to buy separately. There is a proper cassette operating system, as one might expect given an integral deck — you can get a catalogue listing of all files on a tape, for example.

Apart from these options, Amstrad BASIC is unique for small micros in that it's based on a multi-programming concept. This means that you can define certain programming tasks as split off from the main stream of processing, and arrange for these to be implemented whenever a certain condition is met, wherever you happen to be in the main program. This avoids having to remember to put in a lot of messy sub-routine calls for, say, garbage collection. You can also specify for routines to be called periodically at a given time interval, which if you think about it has obvious applications in games.

The list of advanced features is very long. Suffice it to say that there's a full range of text screen formatting functions, that you can divide the screen into up to 255 individually scrolling windows, and that there are no less than four independent timers available. Variables can be specified as integers, and are actually handled as such, making a definite speed saving. Most machines convert integer variables to real variables and back again in the course of arithmetic statements, making them slower. The best BASIC I've seen for some time, marred only by the limited graphics commands.

THE MANUAL

Amstrad CPC464 ■■■■

Commodore 64 ■■

No one can accuse Amstrad of holding out on their customers. The machine comes with a very comprehensive 260 page user guide. This is very thorough, but might look a little obscure to the first time user. On top of this, if you really want to know the machine in depth, two further manuals can be purchased for £19.95 each. A bit steep, but one of the two is a firmware manual, and contains information on all the important sub-routines in the BASIC. This is an enormous boon for the machine-code programmer, since you normally need to wait three years before this sort of information becomes available, usually through the research efforts of users. The other manual is a complete specification of Amstrad BASIC, and will be indispensable to the commercial programmer, though not so important to the home user. A BASIC programming tutorial in two parts at £19.95 each is also on offer. This is an interactive teaching program on cassette.

The Commodore User Guide, on the other hand, is rather more limited at a slim 166 pages. I felt that it was probably O.K. from the complete beginner's point of view, but it's full of holes — you wouldn't know from this book that the 64 had a high-resolution screen! However, a Programmer's Reference Guide is available separately which goes into a lot more depth, and since its launch, a wide range of books have been published about the machine.

EXPANSION

Amstrad CPC464 ■■■■

Commodore 64 ■■

The CPC464 certainly has the edge in memory size, but on the other hand all the Commodore's add-ons are already available off the shelf — many Amstrad peripherals have yet to appear. The Amstrad has a total of 96K of onboard memory. Of this, 32K is occupied by the ROM BASIC interpreter, and 16K is dedicated to the screen. A further 6K is eaten up as BASIC workspace. This still leaves a chunky 42K for the programmer to play with. The Commodore looks similar, with some 38K remaining after the interpreter and operating system have taken their share, but the high-resolution screen, if used, will take another 8K or so out of this.

As for peripherals, the Amstrad comes complete with the two most important. The cassette deck is built-in, and there is a choice of monitors. Either monitor is streets ahead of a conventional TV, and the colour model is spectacular indeed. The colour version will set you back some £329 as opposed to £229 for the green-screen version. The Commodore 64 is ostensibly cheaper at £199 per unit, but once you've splashed out on a cassette deck, an extra £45, it doesn't really look that competitive.

At the time of writing, the other peripherals available for the Amstrad include joysticks — a normal Atari joystick will fit the machine, but since there is only one port, if you want to use two you'll need the Amstrad models at £14.95 each, since these can be chained together. Crafty marketing that. There is also an external UHF modulator allowing you to use a TV at £29.95.

Future CPC64 add-ons will include disc drives and a dot-matrix printer. These will be available in September at £199.95

Amstrad CPC464

For: A very good price for a complete system, tape recorder included, good graphics and sound. A very good buy.

Against: You have to buy bits you may not need, cannot use colour TV, yet another Basic to learn.

Amstrad Consumer Electronics plc,
Brentwood House,
169 Kings Road, Brentwood,
Essex CM14 4EF
Brentwood (0277) 228888



wards the end of the year. Considering the newness of the machine, they've done well in launching a range of some 30 arcade games. The quality of these seemed very high, and I got thoroughly hooked on Roland in the Cave, an arcade adventure with outstanding graphics. I was also favourably impressed by Amstrad Chess, one of the better versions I've seen.

A small range of educational software is also out, and a number of more serious programs including a machine-code assembler/development pack at £21.75, spreadsheet and word-processors at £19.95 and a version of PAS-CAL at £34.95.

VALUE FOR MONEY

Amstrad CPC464 ■■■■■

Commodore 64 ■■■

Commodore 64

For: Sprite graphics, sound synthesiser, lots of software.

Against: Awful version of Basic, makes graphics and sound difficult to use, cassette takes ages to load, machine has a poor reliability record.

Commodore,
675 Ajax Avenue,
Slough, Berkshire SL1 4BG
Slough (75) 74111



One can't deny that Britain is full of happy Commodore 64 owners, but I feel that Amstrad are conclusively demonstrating that the market has moved on, and people's expectations with it. The Amstrad's monitor and built-in cassette alone clinch the contest, and the Commodore falls down on the low quality of its BASIC and the inadequacy of its manual. In its favour, it does have a very wide software base, fed by the enormous American domestic market, but we should see a wider range of Amstrad software available soon.

All in all, the Amstrad is just one of several developments this year which underline the obsolescence of many of the home computers which seemed new and radical only last year. The same could be said of the coming range of MSX machines, and also the Sinclair QL. These new machines will be successful general purpose models, catering to games, word-processing, educational and small business applications with equal flair. However, machines such as the Commodore 64 will still have their devotees, and with a more competitive pricing policy may well still prove attractive to the first-time buyer.

per unit for either, certainly not a bad price for a printer. A second disc drive will be cheaper at £159.99. The discs will come with a version of the CP/M operating system, and an implementation of LOGO, a simple graphics-based educational language. Printer speed will be an adequate 50 characters per second at 80 column print width.

It's worth noting that members of the Amstrad User Club will get a 15% discount off all prices, which makes for good value at £19.95 per year membership.

Unfortunately, the Commodore 64 has no built-in cassette deck, and requires a separate purchase of a specific Commodore unit. This is a bit of meanness in my opinion, and, effectively, the unit has a hidden cost. The machine does have an RGB mon-

itor output, but the monitor too must be bought separately. Disc drives are available from Commodore. The 1541 holds some 170K of data and costs £229 per unit, and the Commodore MPS 801 dot-matrix printer will set you back some £230. The latter will print at 50 characters per second for a 10 inch column width. The machine has two joystick ports which will take a standard Atari joystick.

can recommend Dictator by dk'tronics. There is a great deal of dross available, however, so be careful — make sure you check our review column. Commodore software tends to be a bit pricey too, at £7-£8 per tape.

Amstrad software unfortunately isn't any cheaper, at around £8 per program. However, User Club members get a discount, and Amstrad did feel that prices would get more competitive to-

SOFTWARE

Amstrad CPC464 ■■■■■

Commodore 64 ■■■

The Commodore 64, having been out for some time, has a fair range of software available, some of which is very good. I

RATING

EXCELLENT ■■■■■

VERY GOOD ■■■■■

AVERAGE ■■■

BAD ■■■

AWFUL ■■■

THE triple test ratings match those in the hardware buyers guide. They vary between a single block, which means that the micro in question is seriously lacking in the department under investigation, to five blocks, which means that in this area the micro is one of the best.

AMSTRAD

CPC464 USER

An integral part of the support available to the CPC464 system owner is the monthly user magazine. The universal appreciation of the CPC464 amongst computer buffs means that there is already a surprisingly large amount of expert support available for the system. AMSTRAD CPC464 User is written by these experts (including members of the Amstrad design team).



Letters, plenty of program listings, QA hints and tips, features, reviews of all types of software, new products, peripheral reviews, a directory of all software: in fact a monthly compendium of everything the Amstrad computer owner needs to know to get the most from the system.

AMSTRAD CPC464 User is available on subscription or direct from all good newsagents. It's all about using the CPC464, *so use it yourself!*

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October 1984

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90p October 1984
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**Artificial
Intelligence and
Fifth Generation computing**
Amstrad CPC-464 – today's best buy?
David Levy on programming for games

Denmark DKr34.50, Greece Dra245, Holland DFL8.50, Italy L4100, Spain Pts360, Switzerland SFr7.40, Germany DM9.00, France Fr32.60, Canada C\$4.50,
Australia A\$3.00, Singapore M\$6.35, USA \$3.95(D72162)

AMSTRAD CPC-464

Can the British hi-fi firm make a successful debut on the home microcomputer scene? Ian Stobie reports.

NOT OFTEN is a machine as pleasant to review as the Amstrad CPC-464. It is easy to set up and use, and the documentation is clear and complete. The screen display is rock steady and the cassette system works. Amstrad, better known for budget hi-fi, has come up with a remarkably impressive home computer at the first attempt.

The Amstrad offering is a mid-range home machine, pitched above the Spectrum and aimed at Commodore 64 and BBC territory. For the money it has a good specification and is very complete. For £349 you get a system with 64K of RAM, a built-in cassette drive and, also included in the price, a 14in. colour monitor. For about £100 less you can get an identical system but with a monochrome monitor. These systems are available now, and Amstrad is reportedly shipping 150,000 CPC-464s to U.K. stores for Christmas.

With a £200 disc drive promised for October, Amstrad is also hoping to appeal to the more ambitious home user. The important thing about the Amstrad disc unit is that it comes with CP/M 2.2, which potentially opens up the huge existing base of commercial CP/M software to the home

user. The cost of an Amstrad system suitable for tasks like word processing would work out at around £700, plus the cost of software: £239 for the basic machine with monochrome monitor, £200 for one disc drive and say £250 for a good-quality dot-matrix printer.

Amstrad has obviously taken some care over the styling of its home computer. The CPC-464 is very easy to set up and does not look out of place in normal room. A single cable from the mains goes into the monitor

unit; two coiled cables then connect the monitor to the keyboard unit, one carrying the video signal, the other low-voltage power. The Z-80A processor, 64K of RAM, and 32K of software in ROM are housed inside the keyboard unit, along with the cassette drive.

The standard of construction is good; the keyboard in particular is well laid out and easy to type on. Keys are of proper, business-computer type construction and do not embody any bizarre cost-cutting

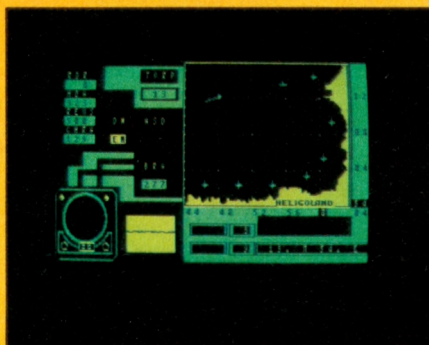
Benchmarks

The table shows the time in seconds to run eight standard Basic routines. Our Benchmark routines test out various typical tasks, each repeating an appropriate set of Basic statements 1,000 times. Particularly interesting are the times taken for Benchmarks 7 and 8. Benchmark 7 puts data into an array, while Benchmark 8 uses log and trig functions.

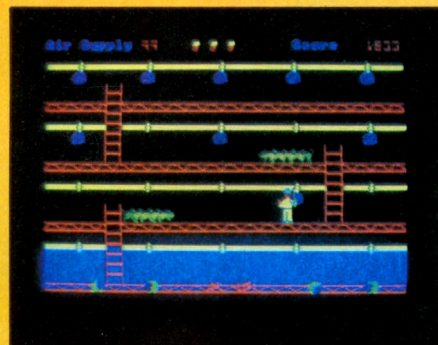
	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Amstrad CPC-464 — Z-80A	1.2	3.4	9.3	9.7	10.3	19.2	30.4	34.3	14.7
BBC Model B — 6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52.0	14.8
Sinclair QL — 68008	1.9	5.4	9.3	9.1	11.8	24.0	42.4	20.7	15.6
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8
Yamaha MSX — Z-80A clone	2.1	6.0	16.6	18.4	19.0	31.7	44.9	216	44.3
Spectrum — Z-80A	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253	58.5



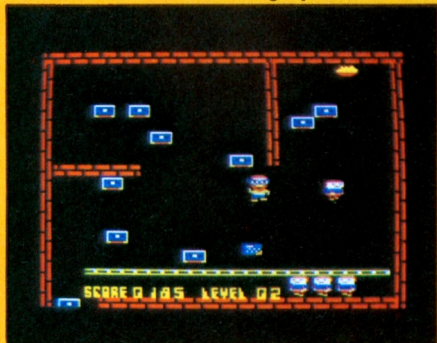
Gems of Strados — nice graphics.



Hunter Killer has a plausible scenario.



Spannerman on the loose.



Sosoftware's Electro Freddie.



Shooting 'em up in Laserwarp.



Master Chess saves unfinished games.

technology. The separate numeric keypad doubles as a set of programmable function keys, while the cursor keys are laid out in a sensible pattern for playing games.

Joysticks are not supplied with the system, but one port of the Atari/Commodore type is provided which will take common brands of joystick. Amstrad's own joystick, available as an option, comes equipped with a second port, letting you piggyback two joysticks together. A Centronics-type printer port is also standard.

The colour monitor unit contains an ordinary 14in. TV-type CRT but the display is far steadier than on a domestic TV, and the colours bright. The monochrome monitor also measures 14in. diagonally and has a green screen; colours are displayed as different green intensities. Across 80 columns the monochrome monitor is definitely the easier to read, but as most entertainment software uses colour and only the 40-column text mode, most users will probably go for the colour version.

The CPC-464 is available only with one of these monitors bundled in, even though the system is quite capable of driving a domestic TV through Amstrad's optional £30 TV adaptor. If you already own a suitable display this policy may seem unreasonable, but given Amstrad's high production volumes the extra cost attributable to the monitor is probably low.

Transportable

The TV adaptor itself contains a 5V power supply for the keyboard unit. Keyboard and TV adaptor together weigh less than 4kg., making this combination quite portable if you are going out somewhere where there is a TV.

The Amstrad has three display modes, all of which offer mixed text and graphics and a choice of colours. The highest-resolution mode gives you 25 lines of text across 80 columns with 200- by 640-dot graphics. Medium resolution is 25 lines by 40

columns with 200- by 320-dot graphics, while low resolution offers you 25 lines by 20 columns with 200- by 160-dot graphics. The number of colours you can use at one time depends on the mode — two in high resolution, four in medium resolution and a total of 16 in low resolution.

Serious use

We did not have the CP/M disc system to review, though it is scheduled for October and is of undoubted interest. Amstrad is offering CP/M not so much to pass its machine off as a budget business system, but in recognition of the fact that many people wish to use more serious software at home.

As 16-bit MS-DOS takes over the lead further up the market in the office sector, Digital Research's CP/M 2.2 seems to be getting a new lease of life by migrating to

ever-cheaper machines. Old CP/M business packages are being recycled at lower prices to a new mass market. It is too early to say what products will be available on the CPC-464, but Amstrad is confident that many of the old favourites like WordStar will make it across to its machine.

The Amstrad disc drive is built around a Hitachi-type 3in. mechanism. It gives you a formatted capacity of 180K on one side of the neat, plastic-encased media; you can then manually turn over and use 180K on the flip side. The choice of the Hitachi system might seem odd, as the competing Sony 3.5in. discs are very reliable and seem to be winning most of the micro-floppy market. But Hitachi drives are cheaper, and it is easier to convert software on to them from more traditional media.

The Amstrad disc unit can have a second, optional drive plugged into it, which can be either a second 3in. Hitachi drive or a standard single-sided double-density

(continued on next page)



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5.25in. drive. Amstrad itself will be offering only a second 3in. drive costing £160, but some software houses are already hitching up standard floppy units to copy their products across.

Software announced so far for the disc system is mostly languages and utilities, with the application packages still to come. Logo — the Digital Research version — will come included in the price with the disc system. C, Forth and Pascal are under development. Amsoft plans to offer an integrated word-processing/spreadsheet/business-graphics/database package, the individual components of which are under development at the moment by software houses Tasman and Saxon.

Some serious packages are available on cassette. Amword is similar to Tasman Software's word-processing program for the Spectrum and costs £20, as does a spreadsheet called Amscal. Cassette-based Z-80 assemblers are available from both Kuma and Hisoft. Amstrad says that cassette data files should in many cases transfer across to disc quite easily; the CP/M BIOS has been written to allow this to be done.

First games

We looked at the first crop of games and educational programs, leaving the serious stuff to a follow-up article when we get a disc drive. The games were of average rather than outstanding Spectrum quality, but this is not bad for a small sample of the eight games first off the launch pad. All these programs, except the Kuma ones, are available from Amstrad's software arm, Amsoft, as well as from the originating software houses. For the Kuma games contact Kuma Computer Ltd, telephone Pangbourne (07357) 4335. The price is £8.95 including VAT unless otherwise stated, which is high by Spectrum standards.

At this stage in the machine's life quantity of software is probably no less important than quality. Most of the important home-computer software houses are interested in the Amstrad, especially Spectrum houses used to writing in Z-80 code. Many software houses have noted the Amstrad's similarity in specification to the Japanese MSX machines and are simultaneously developing software for both environments. Amstrad has adopted a very open policy towards third-party suppliers, offering both technical information and marketing support.

The Amstrad's excellent Basic was written by a U.K.-based company, Locomotive Software. The syntax of most commands is close to Microsoft Basic, but specific Amstrad features like graphics and sound are well supported, and there are some unusual and very powerful new commands.

Of the Amstrad's 64K of RAM, 16K is used for mapping the display and just over

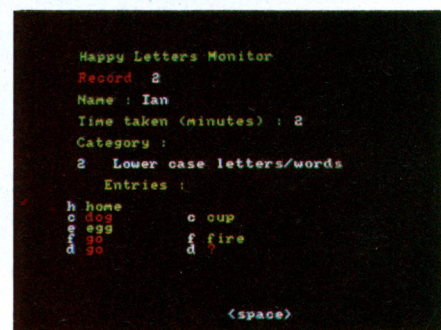
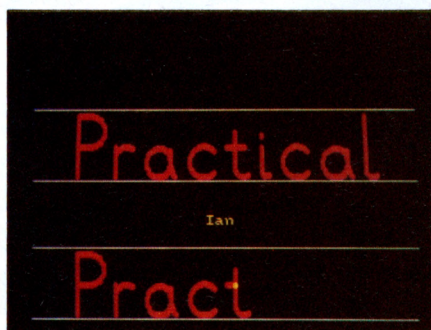
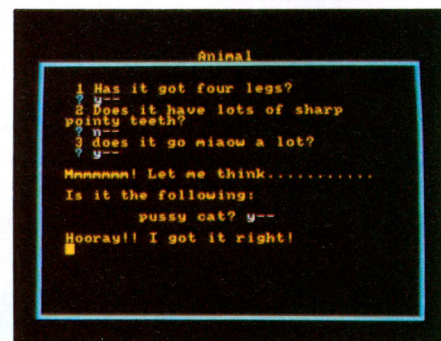
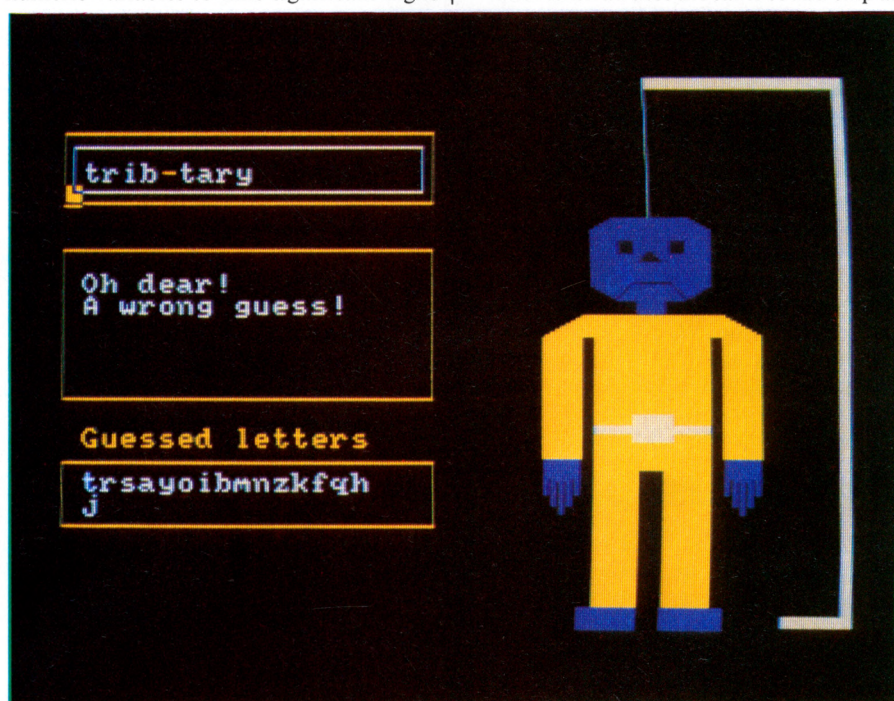
5K is used by the operating system, which leaves a very respectable 42.5K for use by Basic programmers. The Amstrad manages to have a full 64K of RAM memory as well as 32K of built-in ROM, despite the fact that the Z-80's total address space is only 64K. This is achieved by a clever automatic bank-switching arrangement which overlays the ROM into the same address space whenever it is required.

The results of running our Benchmark routine show the Basic to be very fast: faster, in fact, than the QL and the BBC Micro. What is more, the CPC-464 is more accurate than Sinclair's 68008-based wonder machine: the Amstrad displays numeric variables to nine significant digits

while the QL manages just eight significant digits.

A good selection of graphics commands helps put this speed to good effect in creating effective displays. Both relative and absolute drawing and plotting commands are provided, and they all have the same syntax regardless of graphics mode. No sprites are provided, but fast animation effects can be achieved using the Symbol, Locate and Ink commands. Symbol lets you create your own user-defined character set; Locate repositions the cursor; Ink replaces a given colour with another from the palette of 27 possible hues.

The Amstrad uses the same sound chip as



Bourne's educational programs are well matched to their intended users. Illustrations show (from the top) Wordhang, Happy Letters, Animal/Vegetable/Mineral, Happy Writing and the assessemnt screen provided in all the Bourne packages.

the Oric and all the MSX machines, but the Basic controls it in a different way. The chip provides three independent channels each with a range of eight octaves. On the Amstrad, sound is output to the built-in speaker, and also to a hi-fi socket which splits the three channels to produce a stereo effect when connected up to an amplifier or headphones.

The simplest sound command takes the form of

`SOUND<channel, tone, duration>`

More complex commands give you a great deal of control of the shape of the waveform, letting you specify both volume and tone envelopes, in the way that you can with a synthesiser. Unfortunately the

Amstrad's manual has a rather compressed discussion of these facilities.

Very unusually for an eight-bit home micro, the Amstrad has interrupt-driven timers available to the Basic programmer. The Basic commands take the form of

`EVERY<n ticks>GOSUB`

or

`AFTER<n ticks>GOSUB`

Because each of the four independent timers is interrupt-driven there is no need to check them; they interrupt your code as it is executed and divert program flow to the specified subroutine. These instructions greatly simplify writing programs where, for instance, you need to check periodically the status of a few keys, or if you regularly

have to send an object flying across the screen.

The programmer also gets good editing and debugging facilities. I particularly like the way the Amstrad's copy-cursor editing system works, letting you selectively re-enter text already displayed somewhere on the screen, as on the BBC Micro. Traditional line-orientated editing is also available. Listing to the screen can easily be stopped and restarted, and programs can be renumbered. Most usefully, programs in memory can be merged with fragments of code loaded from cassette.

Amstrad's documentation is very good. The users' guide which comes with the

(continued on next page)

Amstrad software

Electro Freddie from Sosoftware is a typical Spectrum cutie game. A Clive Sinclair look-alike figure rather unconvincingly called Claude comes at you as you try to push home computers on to a conveyor belt to ship them out of the factory. He throws Spectrums at you while Orics rain down from the roof. It is quite playable, with four different screens, but nothing brilliant. Rating: 11/20.

Spannerman from Gem Software is more inventive, with an even cuter scenario. You, the village plumber, are in your local earthquake-struck nuclear power plant trying to fix leaks with your trusty spanner. As the radioactive water level rises and debris rains down you rush to tighten up the ever-deteriorating pipework, kicking aside any of the giant mutant power-station rats that assail you. This game has nice noise effects and five levels of difficulty. It is a little like Donkey Kong. Rating: 16/20.

Hunter Killer from Protek is a simulation game, with you crewing a Second World War submarine. The task is to seek out and torpedo enemy subs in the Heligoland Bight area — the problem is both to find the things and to avoid disaster from both enemy fire and your own incompetence. As in most similar games the graphics are rather static, but the simulation seems plausibly accurate and the program notes are good. Rating: 12/20.

Master Chess from Mikro-Gen, still at £8.95, is in a rather different league. The playing standard seems to be high, although this is hard to tell as most chess programs smash me with little effort. The facilities provided are good: you can save half-completed games, set up chess problems, get the program's recommendations for your own moves and flip between different levels of play. Rating: 16/20.

Laserwarp, also from Mikro-Gen, is straightforward shoot-'em-up stuff. There are nine screens, but little changes except the shape of the things coming at you. Your own movements are rather restricted. The graphics are good and the difficulty level quite high, but the underlying Space Invaders concept is a little threadbare. Rating: 8/20.

Gems of Strados from Kuma at £7.95 is a typical adventure game. You wander around a maze of interconnected rooms, picking up objects and seeking a treasure. This one has good instructions and a nice maze display in low-resolution Amstrad graphics. But it also features instant death in ways you cannot avoid, so I found it frustrating. Adventure aficionados might rate it higher, but I give it only 8/20.

Holdfast from Kuma at £5.95 is billed as a non-violent simulation game. We had a preliminary version to review which was text only, but graphics are promised. You are

trying to get a clinic and school for your village, but the militaristic government of Dictatoria, where you live, has other priorities. The problem is to force them to make concessions rather than wipe you out. The program presents various options and then tells you what happens. Rating: 12/20.

Happy Writing is one of four educational offerings from Bourne Educational Software. Most commercial educational programs are fairly poor, so it was with low expectations that I loaded the Bourne offerings. But they turned out to be thoughtfully put together and correspond closely to the age ranges suggested. They are priced at £18.95 each. Happy Writing puts the computer to good use teaching three- to six-year-olds how to write. A moving dot on the screen demonstrates the way letters are formed, and the child is then prompted to copy them with paper and pencil. This sounds rather simple, but it is nicely done, with clear graphics and a few sound effects.

Happy Letters is also aimed at the same age group. Here the object is to get children to recognise letters and to grasp that upper- and lower-case letters mean the same. Several words are displayed on the screen. A moving letter then appears and the child has to hit the Enter key when it is next to a word beginning with the same letter. If the match is correct a fish moves across and gobbles the word. A number of options offer easier or harder words, but this is the general idea. Like all Bourne's educational programs, Happy Letters collects data on how the player is performing. Summaries of the last five players can be displayed, so a supervising adult can come back later to see how things are going.

Wordhang is a fairly straightforward Hangman program, recommended for age five upwards. According to Bourne, Wordhang should encourage children to learn to spell. The program already knows 250 words of varying difficulty. As with the other Bourne programs, players have the option of entering their own words.

Animal/Vegetable/Mineral, for age seven upwards, is a version of the familiar computer game Animals. Here the educational pay-off is in demystifying the computer as the child is actually teaching the computer new things, not the other way round. The player thinks of an object and the program then asks questions about it, each having a yes or no answer. Eventually the computer makes a guess; if this is wrong the child then types in what he or she was thinking of and then suggests a question which the computer could ask to distinguish between the new object and the wrong guess. Even with adults this game has great power to give a feeling of how computers really work — that is quite stupidly and only with information they have already been given.

(continued from previous page)

system is comprehensive, with a glossary, index and separate easy beginners' section. However, I found the chapters on sound and graphics rather confusingly presented. A cassette-based tutorial guide is available for a steep £19.95.

Two additional manuals intended for professional software developers are available also at £19.95 each. One is a Basic reference manual; the other details the operating system and Basic routines contained in the 32K ROM. Few home micros can have had so much information available about them so early in their lives.

Conclusions

● I am aware this is a rave review, but we don't do them very often in *Practical Computing* and it is a relief to find something at the home end of the market that deserves it.

● The Amstrad is a very refined home computer. It is stylish in appearance and well built. Its specification combines the best features of its strongest competitors: 64K of RAM, good graphics and sound, 80-column display and a proper keyboard. The all-in-one concept, with cassette and display included in the price, makes the system easy to set up and use; it also makes the system simple to buy.

● A machine based around the eight-bit Z-80 may seem conservative now that the Sinclair QL has supposedly burst on to the scene. But in performance terms the

Amstrad machine turns out to be faster; in our Benchmark tests its average figure is better than any home computer we have tested, including the QL and the BBC. And most important, Amstrad has been able to deliver working machines in quantity.

● Against the heavily hyped MSX machines, the Amstrad stands up well. It boasts a standard 64K against varying — usually smaller — quantities of memory in the Japanese machines. Again, the Amstrad is actually available now.

● The expandability of the Amstrad system is good, with provision for attaching printers and other third-party add-ons. Amstrad's promised disc drive offers CP/M, which must be of considerable interest to those interested in doing more than playing games.

● The initial range of software is encouraging. None of the programs we reviewed were brilliant but, on a small sample, the quality is average to good. The Bourne Educational Software range of programs, also available on the BBC Micro and Electron, deserve the attention of anyone with small children.

● The documentation is of unparalleled completeness for a product at this stage in its life. The user manual which comes with the system is very thorough, although at some points a bit confusing.

● The CPC-464 is a very competent machine, very competently sold and supported. It will undoubtedly sell in large numbers, which is a further good reason for owning one.

Specification

CPU: eight-bit Z-80A running at 4MHz
Memory: 64K RAM; 32K ROM containing Basic and Amstrad operating system

Display: 14in. colour or a green monochrome monitor included in the price; optional £30 adaptor is available to drive a domestic TV; three screen modes give 25 lines of 20-, 40- or 80-column text and graphics in three resolutions: 200 vertical dots by 160, 320 or 640 horizontally; text and graphics can be mixed and colours chosen from a palette of 27 shades; up to 16 different colours available at a time, depending on mode

Sound: three-channel eight-octave sound with tone and volume envelopes and white-noise generator, programmable from Basic; built-in speaker and stereo headphone output socket; uses AY-8912 sound chip

Cassette: built-in tape cassette deck for program and data storage; transfer speed software selectable, with pre-recorded cassettes automatically loading at either 1,000 or 2,000 bits per second

Discs: optional 3in. Hitachi disc drive, 180K per side, promised for October; drive will come with CP/M version 2.2 and Digital Research's Logo in the £199.95 price; additional second drive unit to cost £159.95

Interfaces: Joystick port, parallel printer port, stereo sound output, RGB monitor output, expansion bus for discs and other optional add-ons

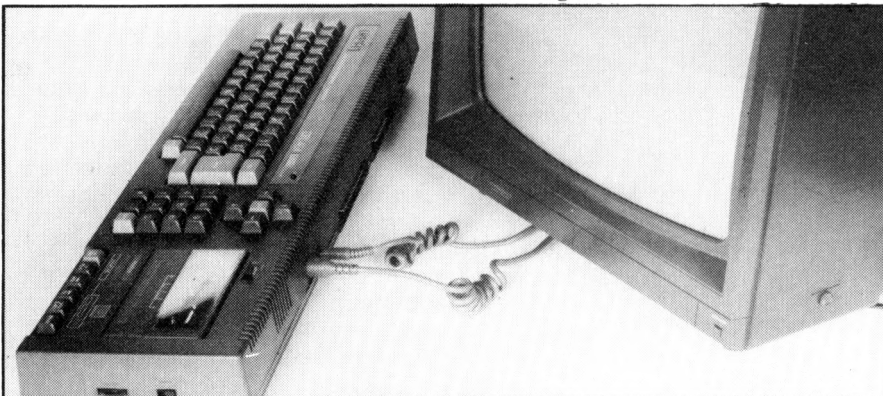
Size: Keyboard dimensions 570mm. (22.4in.) by 165mm. (6.5in.) by 70mm. (2.8in.); colour monitor 365mm. (16.3in.) by 360mm. (14.2in.) by 340mm. (13.4in.)

Weight: keyboard weighs 2.4kg. (5.3lb.); colour monitor 10.6kg. (23.4lb.); monochrome monitor 6.3kg. (13.9lb.), optional TV adaptor 1.4kg. (3.1lb.).

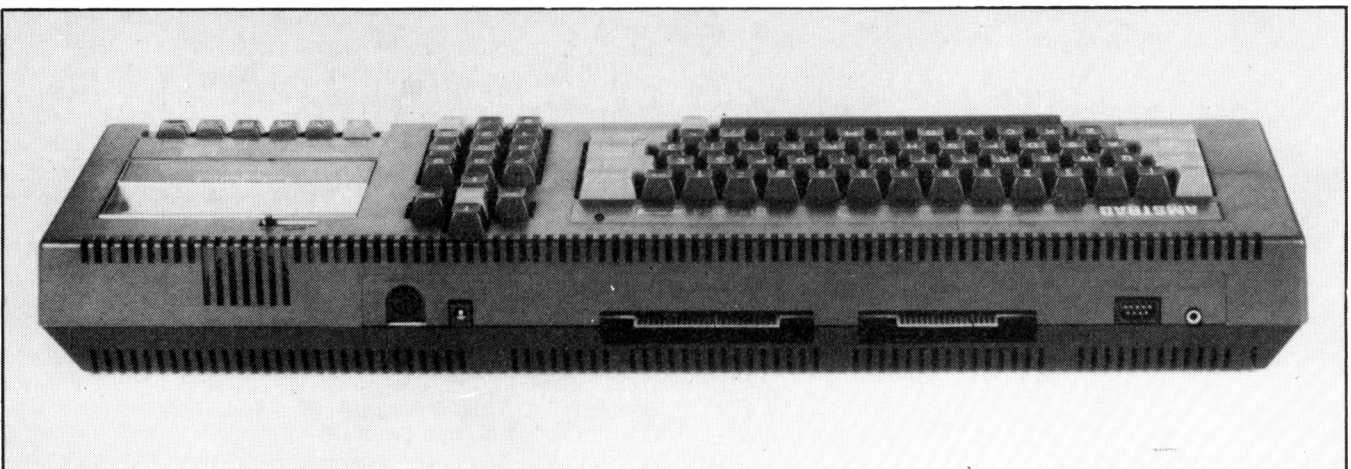
U.K. price: £349 including VAT for Amstrad with 64K of RAM, built-in cassette and 14in. colour monitor; monochrome version costs £239

Manufacturer: made in Korea for U.K.-based Amstrad Consumer Electronics plc

U.K. distribution: Amstrad, 169 Kings Road, Brentwood, Essex CM14 4EF; telephone (0277) 228888; available immediately



Video and power cables connect keyboard and monitor.



From the left: monitor, power, disc, printer, joystick and stereo/audio interfaces.

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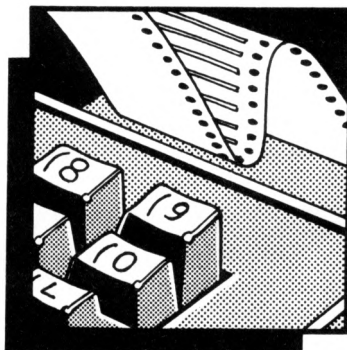
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Amstrad CPC464

Already well known for their budget priced hi-fi equipment, Amstrad have launched a complete home computer system onto the U.K. market. Simon Rockman sounds it out.

AMSTRAD

The Japanese might as well pack up their MSX machines and go home! Even Commodore and the famous names of Cambridge would be advised to return to their spread-

sheets and change a few figures. The Amstrad CPC464 is really wonderful, giving the value for money one would expect from Sinclair. From playing with the computer at

the launch, it was clear that a micro with colour monitor for less than £330 was a bargain, so I ordered one, persuading myself that even if it was no good, I had paid very little over the odds for a colour monitor to use with my Sinclair QL. That the Amstrad turned out to be such a good computer was a pleasant surprise.

The mysterious ways of marketing

The derivation of the name is curious. CPC stands for Colour Personal Computer, but the 464 doesn't appear to signify anything except in relation to the proposed titles of the new Commodore machines, which were to have been the 164, 264



and 364, the latter of which will not be available in the U.K. Amstrad have no plans to launch their machine in the U.S.

Marketing is one aspect which will contribute to the Amstrad's success, the quality and availability of software will be another. The Amstrad has a Z80 processor and because of this, it will be the ideal upgrade for Spectrum programmers who want something more powerful. The Tasword word processor will be available shortly and lots of software houses are already converting their programs to run on the Amstrad.

System sense

The Amstrad is sold as a system, comprising the processor with built-in cassette deck and a separate monitor. Two monitor types are available, green screen and colour, with a £100 price difference between the two.

The system comes packaged in two boxes, one for each monitor and keyboard, which presumably allows for easier supply of the colour or mono systems. At the moment there is no facility to enable owners of mono system to upgrade to the colour. Separate monitors will probably be on sale early next year, and Amstrad have laid down contingency plans

for this by allocating the RGB socket as the monitor connector. Thus one could plug the Amstrad monitor directly into a BBC which should provide a large market for them.

Amstrad do not lay down any claims that their monitor is high quality — it is really just a television with parts removed. However, an RGB display is much clearer than a modulated one and the Amstrad's is very sharp indeed. The green screen gives an even crisper display and is probably the one to go for if you intend to use your micro for word processing.

The whole Amstrad system is powered from the monitor. The display is plugged into the mains and this feeds the computer and tape deck. It is a shame that the small detail of a mains plug was omitted. There are power switches on both the monitor and computer. Sound is produced through a speaker within

the computer and there is a mechanical volume control.

Keyboard and tape-deck

The keyboard is soft without being spongy, a hybrid of the old style BBC and the CBM64. It is easy to reach quite high speeds on it. The same keys are used for cosmetic reasons on the tape deck, but press down in the usual piano style.

Only the cassette motor is controlled by software. The Fast Forward and Rewind keys must be used manually. The tape system works at two speeds, 1000 baud and 2000 baud, both of which are reliable and, since speed detection is automatic, there is no need to use different load commands or modes for each.

Above the tape deck controls is a useless diagram showing where bits of the system are in

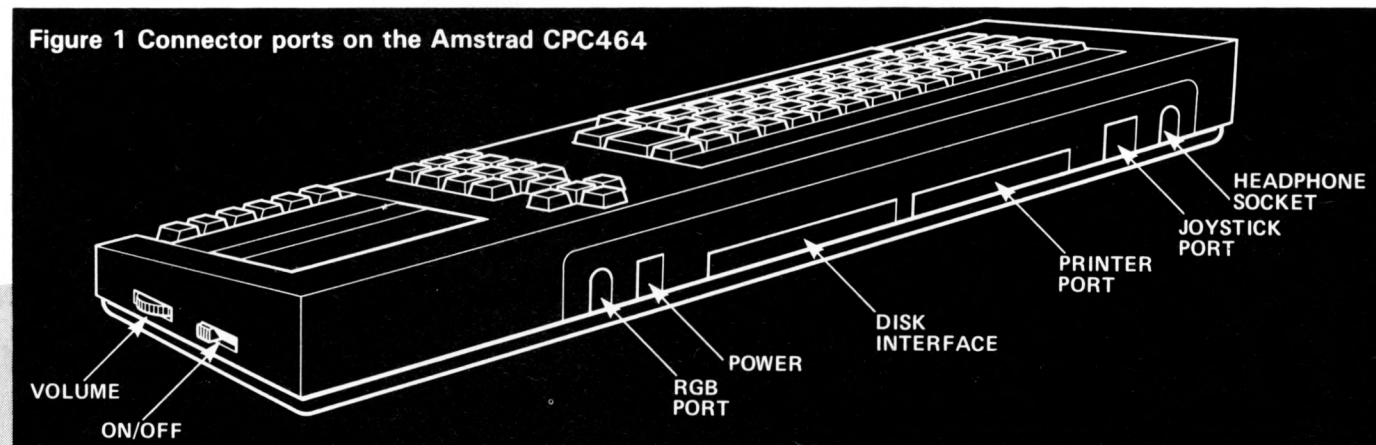
relation to each other. Anyone who needs a picture to show them this information, should not be buying anything as complex as a pocket calculator, let alone a computer! This space could have been better utilised by displaying a table of the default or available colours in each mode.

Connections

Figure 1 shows the ports at the back of the Amstrad. The farthest left of these is the headphone socket, labelled I/O. I could not get this to work since it requires external amplification. There is a single joystick port which is Atari (D9) compatible. It is possible to add a second joystick by using the Amstrad JP1 as your first joystick. This has a similar socket in its base so that a rival player can plug in his joystick to yours. Make sure that player one is trustworthy — you don't want them pulling the plug at a crucial moment!



Figure 1 Connector ports on the Amstrad CPC464



Amstrad CPC464

Moving right, there is a parallel port which is centronics compatible. However, because the computer end is an edge connector it requires a special cable. Next to this is the most exciting expansion port. Labelled disk expansion, it provides a connector for the mini disks which will be available for Christmas. They will cost £199 including the CP/M business operating system and LOGO. A major limitation of the Amstrad as a cheap comprehensive business system may be this choice of unusual disk size, but only time will tell.

Next to the disk connector is the power socket which takes the lead bringing power via the monitor. The second lead from the monitor plugs into the RGB socket. Both these leads are coiled.

The whole unit is encased in solid PVC moulding. The monitor case is more rigid and is plastic. This could do with more shielding around the screen, since interference from the latter is a problem. The on/off switch and volume control are on the side of the unit.

Words

The documentation for the system is first rate.

It has a similar feel to the early Tandy manuals, well broken up into manageable chunks by the odd cartoon, and is not boring to wade through even for the expert user. Not all the technical documentation is in its final form but software houses are being sent proofs and the extra information contained in the 'Advanced Manual' will be on sale to the public for £20.

Better BASIC

Each new micro seems to bring it's own 'improved' BASIC. The CPC464 uses a BASIC written by Locomotive Software, a software house which specialises in Microsoft type BASICS. They wrote the professional BASIC for the Acorn Z80 second processor. The roots of the Amstrad BASIC are clearly in Microsoft, *a la* Oric, CBM64, *et al*, but several extra commands have been added to use some of the machine specific features of the Amstrad.

One of the most unusual of these is the interrupt processing. This is supported by the commands AFTER, EVERY and REMAIN. These make use of the Amstrad's four built in clocks which are constantly ticking away. By using the command: AFTER 120 GOSUB 100,

Table 1 BASIC commands on the Amstrad CPC464

ABS AFTER AND ASC
ATN AUTO BIN\$ BORDER
CALL CAT CHAIN CHR\$
CINT CLEAR CLG
CLOSEIN CLOSEOUT CLS
CONT COS CREAL DATA
DEF DEFINIT DEFREAL
DEFSTR DEG DELETE DI
DIM DRAW DRAWR EDIT
EI ELSE END ENT ENV
EOF ERASE ERL ERR
ERROR EVERY EXP FIX
FN FOR FRE GOTO
GOSUB HEX\$ HIMEM IF
INK INKEY\$ INP INPUT
INSTR INT JOY KEY
LEFT\$ LEN LET LINE
LIST LOAD LOCATE LOG
LOGIO LOWER\$ MAX
MEMORY MERGE MID\$
MIN MOD MODE MOVE
MOVER NEXT NEW NOT
ON ON BREAK ON ERROR
GOTO ON SQ OPENIN
OPENOUT OR ORIGIN
OUT PAPER PEEK PEN
PI PLOT PLOTR POKE
POS PRINT RAD
RANDOMIZE READ
RELEASE REM REMAIN
RENUM RESTORE RESUME
RETURN RIGHT\$ RND
ROUND RUN SAVE SGN
SIN SOUND SPACE\$ SPC
SPEED SQ SGR STEP
STOP STR\$ STRING\$
SWAP SYMBOL TAB TAG
TAGOFF TEST TESTR
THEN TIME TO TRON
TROFF UNT UPPER\$
USING VAL VPOS WAIT
WEND WHILE WIDTH
WINDOW WRITE XOR
XPOS YPOS ZONE

subroutine and then RETURNS to where it was before it was so rudely interrupted. The command, EVERY, works in a similar way, calling the subroutine endlessly at equal intervals. This could be very useful in adventure writing for adding the odd, random "You hear a rumble of thunder in the background", or the command AFTER, could be used to delay the result of an operation.

If you fed some deadly coal to a dragon you might want to wait a while while the dragon digested it before it is poisoned. The AFTER command could specify the delay, and the subroutine it calls could PRINT the message "the dragon has just dropped dead". The REMAIN command tells you how long there is to go on any timer and resets it to zero before switching it off. It is possible to disable the interrupts using the DI command so that important tasks are not interfered with. They can be re-enabled with EI.

Colour codes

Colour is supported with the Spectrumsque BORDER, INK and PAPER. There is also a PEN command which allows you to assign an INK to the pen and PAPER. There is a palette of 26 (27 if you include black) colours to choose from and it is possible to switch colours instantly which opens up great possibilities for animation. Characters can be drawn in black on a black background and the colours flipped to make them appear. Many of the most impressive BBC programs make use of this facility. The INKs can be

you can call a subroutine at a specified time rather than from a specified place in the program. The program will go past this line without stopping, the clock starts counting and 120 1/50ths of a second later the program goes to line 100, executes the



set to flash at any one of 65536 rates. The MODE command switches between the 20, 40 and 80 column displays which give 16, 4 and 2 PENS respectively.

The plotting and line drawing commands are simple to use with options for relative as well as absolute movements. Circle and Fill commands are regrettably omitted but then you can't have everything. When using characters, high resolution can be simulated with the SYMBOL command, this allows you to specify a part of the character set and to redefine it. The TAG instruction causes a trail to be left behind a character which, although useful for some special effects, has a minor bug associated with it resulting in control characters appearing when they shouldn't. This can be programmed around with a semi-colon.

Structured programming buffs will be disappointed by the lack of procedures since once you have got used to using them, a return to GOSUB-ing seems a trifle crude. The WHILE and WEND commands go some way to adding that missing ingredient but I prefer procedures. Games players have JOY to keep them amused and help them examine the JOYstick, while serious programmers have a host of profes-

sional BASIC type commands in their vocabulary. LINE INPUT imposes better checks than the standard INPUT command and LOCATE aids screen formatting, as does PRINT USING. There are all sorts of ways to alter numbers by rounding, truncating and making them real or floating point. Strings can be set to upper or lower case with one operation. All the things for which most programmers end up writing a subroutine. Windows and streams are supported which provide the hooks for a mini LISA system.

For those who like spending their time zapping aliens there are sophisticated envelope shaping controls to ensure that you remain master of the AY-3-8192 sound chip, it's just a shame that the speaker is so feeble. The sound through the headphones is in stereo.

Conclusions

To sum up the BASIC is one of the nicest 'ordinary' ones I've used; it lacks the nice non-BASIC features of the QL and BBC versions but does not fall between the two stools of being standard or good.

One area in which I found the Amstrad confusing was that of editing. There are three edit modes. The first requires

Table 2 Specifications

Processor	Z80A at 4 MHz
RAM	64K with 43K bytes free from BASIC
ROM	32K

Graphics Resolution:

40 column text 200 × 320 4 colours from palette of 27
 80 column text 200 × 640 2 colours from palette of 27
 20 column text 200 × 160 16 colours from palette of 27

Sound 3 voices over 8 octaves

Provision for 255 sideways ROMS/RAMS

Prices:

Green screen monitor	£229
Colour monitor	£329

Available from W H Smith and leading computer stores.

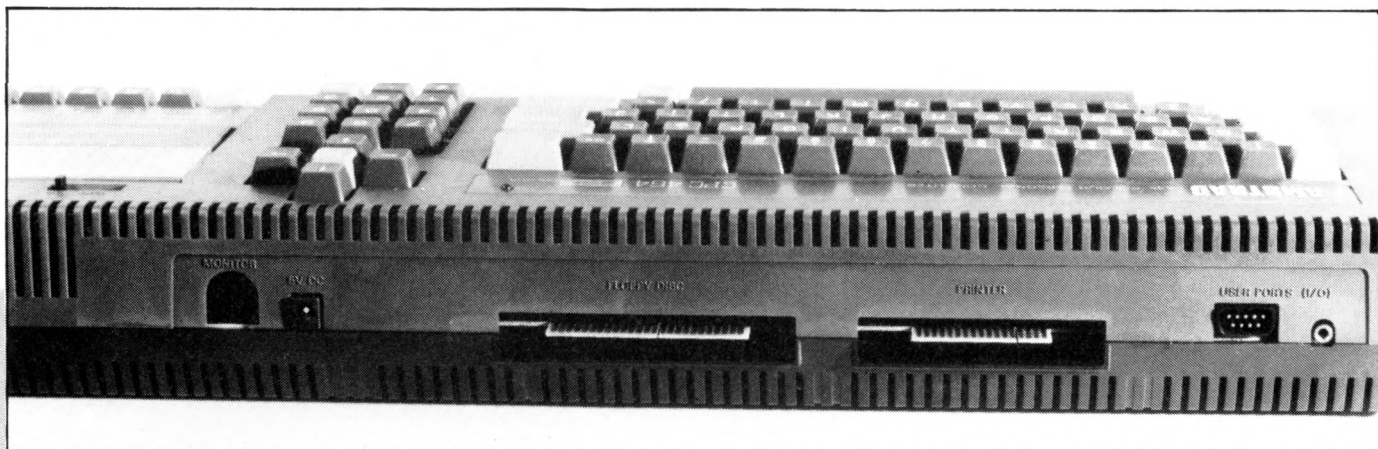
you to type EDIT (line number) and presents you with the line to be changed as on the Tandy or Dragon but with proper inserting facilities. The second gives you a copy cursor as on the BBC and the third mixes the two with copying on the line you wish to work on. I wish that all manufacturers would use an MSX/Commodore/Sharp full screen editor, they are so much easier and logical to use.

Future plans

Immediately on the horizon are the floppy disks but the prototypes run very, very hot. However, Amstrad have been better than anyone

about producing working products on time. If they say that there will be working disks for Christmas I believe them.

Whispers of unannounced products include a modular ROM board system to allow you to plug in up to 255 'sideways' ROMs like the Beeb, a 68000 second processor to give real punch to the computer's processing and, when the prices come down, a machine with integral hard disk. These projects are all a way off so don't wait. This machine is the one to look at if you've been thinking of a new computer, the BBC/B may not have too much to worry about but the Amstrad knocks spots off the Electron and CBM64.



LIST OF OVERSEAS AGENTS FOR CPC464

1. **SPAIN: INDESCOMP.**
P. Castellana, 179, 1. - Madrid-16
Tel: 279 31 05
Tlx: 47660 INSC. E
2. **IRELAND: REYNOLDS ELECTRONICS LTD.**
Finnabair Industrial Park
Dundalk Co. Louth. Ireland
Tel: 42 31281
Tlx: 33839 RENL EI
3. **TURKEY: EKA in Istanbul (Elektronik Kontrol Aletleri Sanayi Ve Ticaret AS)**
All business done via their buying office in London SUPREMIA.
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4. **ITALY:**
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Largo Porta Nuova
14-24100 Bergamo
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5. **DENMARK: DINAMICRO APS.**
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Tel: (01) 88 02 88
Tlx: 19319 DINAM
6. **NORWAY: INFORMASJONSSYSTEMER AS**
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Tel: 472 50 10 80
Tlx: 17529 N.
7. **FINLAND: TOPTRONICS LTD.**
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Tlx: 62699 TOP SF
8. **GREECE: COMPUMAK LTD.**
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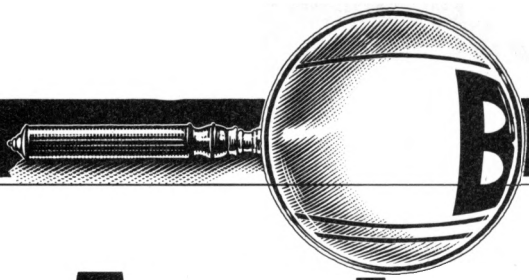
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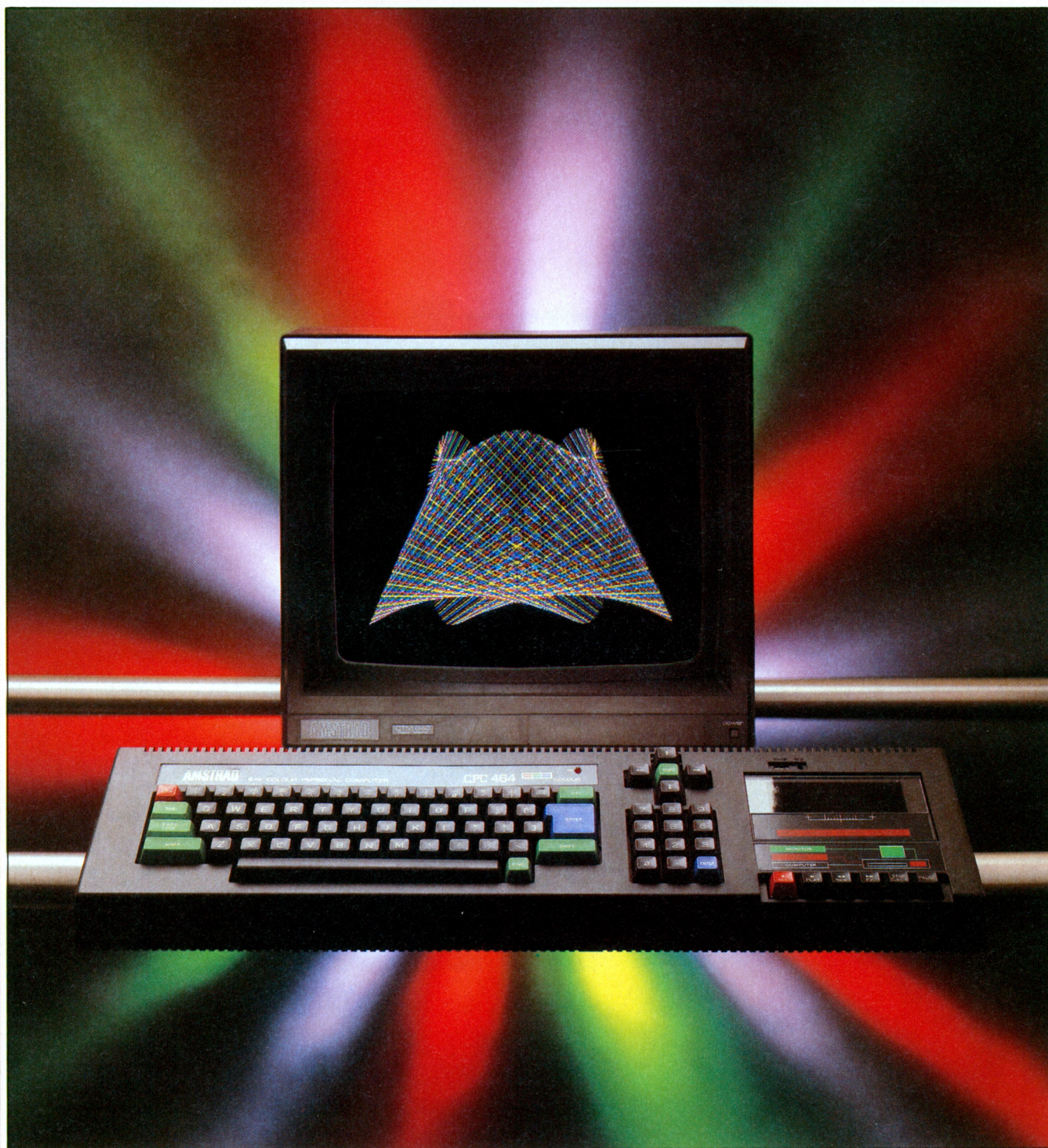
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Amstrad CPC4 64

The time of true microcomputer consolidation is upon us in the shape of the Amstrad CPC464, which in two boxes and one lead includes a list of features that would shame a hybrid of the major machines. Guy Kewney examines this fast and powerful home/business micro which will be launched as a direct and effective competitor to the Commodore 64, Sinclair Spectrum and BBC Micro.



The moment when hi-fi broke away from its 'enthusiast' image and started appealing to the mass buyer is hard to pin down, but a major step must have been when suppliers put all the typical components into one neat and tidy box.

That moment may have come in the computer business with the arrival of a machine nicknamed 'Arnold'.

The Amstrad CPC464 is one of the first home micros to be sold with its own display (rather than a TV aerial socket), its own tape player rather than 'MIC' and 'EAR' sockets, and its own loudspeaker with volume control and no tangle of wires. It costs £200 for a high resolution monochrome (green) display version and £300 for a medium resolution colour display. It is a startlingly simple design with nearly all the better features provided by software, not silicon chips.

The list of features is considerable. It includes stereo sound, real-time interrupts, considerable ability to expand with external hardware, joystick port, built-in loudspeaker (and volume control), friendly Basic, automatic tape control, fast program loading and windows.

These features could have been provided on a Spectrum, if Sinclair had thought to put them in an Amstrad-type unit rather than supply them as components of a system which the buyer has to accumulate.

The Amstrad's designer, Roland Perry, made it clear that the package had been put together to compete with the Commodore 64, be better value than the Spectrum and decidedly cheaper than the BBC Micro.

What makes it different is not the price, but the fact that there are just two boxes and one power lead.

The display is plugged into the mains and you plug the computer, all in one box, into the display. This fits in with Amstrad boss Alan Sugar's idea of how the average British family buys electronics.

'Our concept has always been to supply a product that the consumer can use straightaway,' he said. 'And as it's too cumbersome to wrap the thing up in

its cables and tuck under the bed, it'll have to be used!'

It is also likely to find its way into business use; with a disk, 80-column display and CP/M it will cost £400 or less.

The name 'Arnold' derives from the days when Perry was an outside consultant to Amstrad, and was talking about the still-secret project to software houses. 'It's a well-known consumer electronics group,' he hinted, 'and if I say that we've called the machine Arnold, does that give you a clue?' It did, but I don't know whether Sir Arnold Weinstock ever heard about the secret project under way somewhere in the GEC empire.

Hardware

As regards electronics there isn't much difference between the Amstrad and a Sinclair Spectrum. There is a Z80 talking to 64k of memory, a display controller talking to the same 64k, and a gate array. The gate array does the clever memory switching. Memory is arranged so that the 32k of permanent memory is split. The gate array can point either to ROM or RAM at the ROM addresses.

The top 16 of the 64k is either Basic or holds the screen contents. The 16k is either firmware or the area where the user's program code starts. A similar concept is used in the Commodore 64 to give more space than an ordinary 16-bit addressing micro can manage.

The bottom thousand-odd bytes is duplicated from ROM to RAM so that the all important restarts are available at the same address, whatever is happening with the gate array. The firmware copies itself into RAM at the same address at start-up. External control of the system is possible using this memory switching system. On start-up, the system checks all known memory addresses to see what is plugged in. Part of the check involves switching through 240 'pages' of possible external memory to see if anything is there. The program checks a particular memory location in the top 16k of each page and, if you plan to make an

add-on, you must put its name in that location. Basic sits in page 1.

Computer enthusiasts will note that there is something with a higher priority than Basic, and that's whatever you choose to plug into page 0. The obvious thing is a plug-in ROM cartridge to drive the firmware. To make a ROM cartridge provide 16k of ROM, make sure it is addressed at page 0 out of the 240 extra, and read the Z80 chip signals on the expansion bus.

Communications with other systems can be handled through this port. On the back of the box the expansion port is labelled 'floppy disk' and will be used as such.

Control is passed to external memory by handing Basic a command beginning with a 'bar' i, followed by the name of the relevant ROM. Firmware will know the names of the top 16k pages. Typing !BASIC causes firmware to move to the start-up point of the Basic ROM, causing, in effect, a complete system reset.

The display controller and the processor are synchronised so that they never access memory at the same time. The effect of this on the processor is that it cannot process more than three machine cycles without going into a wait state. The software has been designed around this constraint for speed. Although theoretically the clock ticks three times for processor and once for display, giving a 25% degradation of processor speed, sufficient Z80 instructions fall inside the three-cycle boundary to improve on this (according to Locomotive Software, which wrote the operating code).

The hardware includes four sound generators triggered by software (three notes and one 'noise'), a standard industry feature. These can be modulated in much the same way as the BBC Micro sound channels. However, they have the unusual feature of stereo separation. The first channel is fed to the left side of the stereo output, the second is fed equally to both, and the third is fed to the right side alone. The sound emerges from a standard Sony Walkman outlet on the main keyboard,



The Amstrad CPC464: 'better value than the Spectrum, and cheaper than the BBC.'

and a headphone wearer will get full stereo sound. Amstrad is also stocking an optional accessory — a cable to link computer to hi-fi systems.

Also in the box is the cassette player/recorder. The advantage of having this supplied with the system is not just one of convenience: it also allows the software designer to work with a known standard cassette performance. Amstrad has taken advantage of this to provide a high performance tape: the cassette unit will record and play back at 2400 baud.

For safety, the designers have been slightly more conservative with two standard tape data speeds: 1000 bits per second; and 2000 bits per second. If Amsoft, the publishing division of Amstrad, decides that 2400 is safe, the user will never know because the detection of speed is entirely automatic on software load.

Display

The two monitors are standard so can be used for most other home micros with RGB output. The colour monitor is not the best in the world — an Amstrad TV picture tube — but compared with the display provided on a home TV through a UHF modulator, it is precise and clear.

The green screen is much clearer, and while no-one will really be happy working in 80-column mode on the colour tube, the green mono display is a good, standard 14in video output. The business user could have a green display at work and a colour display at home, carrying the compact console from one base to the other, but Amstrad suspects that people will buy a green screen and a modulator box.

The modulator box costs £30, and, like the monitors, provides low-voltage power for the computer. It has a colour output which will plug into an ordinary TV, producing a somewhat better picture than most British micros, which is to say, about as good as a Commodore 64 TV output. As with the BBC Micro, it really isn't possible to read 80-column print on a TV display.

Keyboard

The keyboard compares unfavourably with the Commodore 64 but is on a par with the BBC, giving it a distinct advantage over the IBM PC Junior or Sinclair Spectrum.

There are no diodes in the keyboard, and the only keys wired together are the two SHIFT keys. There is a numeric keypad in addition to the numbers on the top row of the qwerty keyboard, and the cursor and editing keys are separate too. Software can read the keyboard directly, making even SHIFT and CONTROL keys valid Basic inputs if needed. But as the keys are switches on a simple matrix, there is a low limit (three keys can be too many) to the number of

buttons you can hold down together and still expect the computer to understand what you are doing.

The system reset is generated by holding down three keys together on the keyboard, SHIFT, CONTROL, and ESCAPE, in that order. It cannot be done by accident. Colour display is generated by the hardware, using a palette of 27 colours, and is modified by the software into three 'modes' of display. All other Amstrad features are provided by the software.

Expansion

The Amstrad is very expandable, but Amsoft, which will market the machine, is not planning to clutter up its catalogue with expansion items. The company will release an ordinary joystick, the modulator (for TV use) mentioned here, and possibly, one day, a serial interface.

Still secret, but much closer, is a design for a diskette drive. Locomotive is reportedly working on an extension to its Basic which will create disk files on an add-on device. The disk files are intended to be compatible with CP/M, and may well bear fruit before the end of the year.

It is likely to be a choice between the standard 5¼in drive and the 3in Hitachi drive.

Software

This falls into two categories: Basic and firmware.

Basic

This is fast, faster than nearly all other 8-bit Basics and some 16-bit Basics, too.

Locomotive Basic is known to some UK business users in an earlier version, which is almost indistinguishable from Microsoft standard Basic, right down to the editor. This is an enhanced version with many new functions in sound and graphics, and includes extra features to

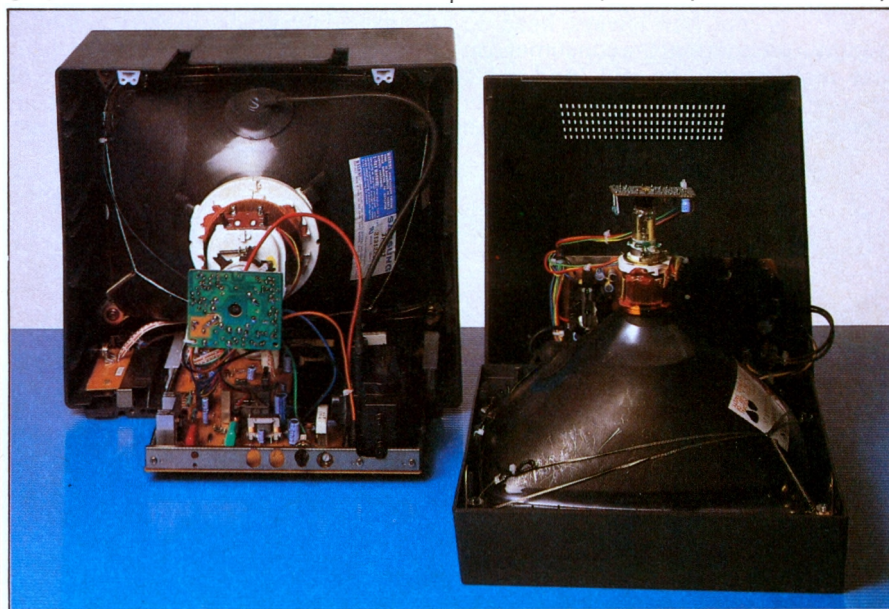
make programming less of a chore.

Locomotive believes it is perfectly sensible to write arcade games using this Basic, and that software houses are doing so. It says it is easy to write in, and very fast. Well, how fast is 'fast'? The value of the PCW Benchmarks is often doubtful, as many operations have to wait for information from disks and others depend on the time taken to draw shapes on the screen.

However, Benchmarks do test the ability of the Basic to do the arithmetic essential in plotting and drawing. On this system, plotting and drawing are done by the Basic and firmware working together and not by a special graphics chip, so the speed of the Benchmarks is more than slightly relevant.

The speed of Locomotive Basic has its penalty, however. It is achieved by clever use of the Z80 internal registers for storage of the main system pointers. Information about the next line to execute, where the variables are, and so on, is very quickly available to the interpreter, but there can be no recovery from a serious crash. It is not possible to create a command to correspond to the BBC Micro's 'OLD', which gets the amateur code writer out of trouble. Press RESET, and the system is irretrievably lost.

Several things about Locomotive Basic will surprise experienced Basic users. The list includes interrupts, streams, graphics, sounds and windows. The concept of 'stream' input or output is a foundation of Locomotive Basic. It's a neat way of arranging the odd collection of commands like PRINT, DISP, OPEN PRN and LPRINT. There are 10 input and output streams specified by the commands PRINT and WRITE for output, INPUT and LINE INPUT for input. They are referred to by



The colour monitor uses an Amstrad TV tube with RGB input

a number, worked out from a Basic variable.

Stream #0 is the main screen window. Until somebody defines it differently, it covers the whole area of the screen. A simple PRINT "PCW" statement assumes window #0, which is also stream #0, and so can be written as PRINT #0, "PCW". Streams 0 to 7 are screen windows, stream #8 is the printer, and stream #9 is the cassette output file. On input, streams 0-8 are the keyboard, with prompts sent to appropriate output streams. Stream #9 is the cassette input file.

The advantage of this is that a program can be tested on the screen display, and then easily altered to send output to the printer by using a variable, such as EPSON, as follows:

```
10 EPSON = 0
20 PRINT #Epson, "This is going to
  the printer"
30 DISPLAY = 0
40 Print #DISPLAY, "This is going to
  the screen."
<other print statements>
```

1000 END

Until you have finished debugging the program and change line 10 to set EPSON to the number 8, all printer output will go to the screen. This is the only change the programmer has to make to switch streams.

At the moment, having two tape streams, one to read to and one to write, is nonsense as there is only one tape drive. However, one stream could theoretically be redirected to a disk when this becomes available. Input is also possible outside the stream concept, by directly reading the keyboard or the joystick port with INKEY and INKEY\$, and JOY commands.

Windows are easily defined by the WINDOW command, which sets the window number, then the left, right, top and bottom corners. Each window has its own characteristics within the limitations of the display mode being used, but changing mode will reset all win-

dows, including the graphics screen.

Graphics

Graphics on the Amstrad is a sensible collection of the more successful attempts at standard drawing and plotting commands on most established micros. The graphics commands are as follows:

CLG to clear the graphics screen.

ORIGIN sets the position of the 0, X and Y coordinates, and also defines the limits of the graphics screen window.

DRAW and DRAWR are absolute and relative line drawing commands; and MOVE and MOVER move the pen to the new plotting position without marking the screen in-between. PLOT and PLOTR similarly mark a single point either absolutely or relatively. TEST and TESTR move the cursor to a given point and report the ink colour used there.

TAG and TAGOFF allow Text At Graphics cursor for labelling diagrams. If the graphics routine has become confused with relative moves, XPOS and YPOS commands give the position.

Colour

Colour is very simple: explaining colour on the Amstrad is another story.

In mode 0, there is a 20-column (VIC-like) display, with 16 colours possible on screen. In mode 1, the screen moves to a 40-column display with four different colours, and in mode 2 to 80-column with two colours; except that there are 27 colours, all available to the three modes!

Roland Perry did his best: 'Think of each mode as having a certain number of pens, in which you can change the ink,' he said. 'In mode 0, there are 16 pens, in mode 1, there are four, and in mode 2, there are two.'

The trouble with this explanation is that a screen, already printed in INK 1, will entirely change colour if the program redefines INK 1. You might expect the following lines to change colour, and they do, but so do the previous ones, because you cannot get more

colours on screen than the mode allows.

Ten minutes pushing keys makes it all quite clear, but hours spent with the manual are hours wasted in frustration.

Sound

Sound follows the BBC Micro's precedent in allowing complex sounds controlled by complex envelopes. On the Amstrad, you can use as little or as much of the ENVELOPE command's power as is required.

Sound is started with the SOUND command. All that is essential is the channel and the note. Optional features are the volume, the length of the note, and two envelopes.

A tone envelope controls variations in pitch and a volume envelope, called ENT and ENV respectively.

It's possible to synthesise very complex sounds with these envelopes, coupled with a sophisticated series of commands to ensure that chords synchronise with each other through sound queues, rendezvous parameters, sound queue flushing commands and sound hold commands.

Interrupts

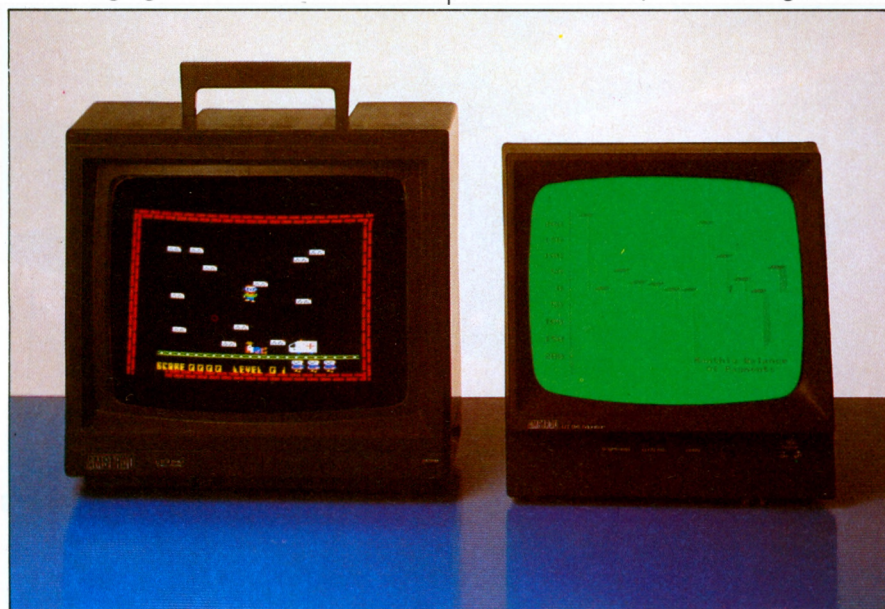
The machine has four internal clocks, which are available to the programmer and used to trigger interrupts. Interrupts have been, until now, something that only machine code chip programmers knew about. Basic ignored them. This machine allows the home programmer to discover the horrors of real-time code. You please yourself what you use them for, but the options are complex.

The command AFTER sets one of four timers (you specify which) to start counting in fiftieths of a second, and then generates an interrupt which leads to a subroutine, as in AFTER 100,0,GOSUB 1000, which sets timer zero to call subroutine 1000 after two seconds. The command EVERY does the same thing, but regularly.

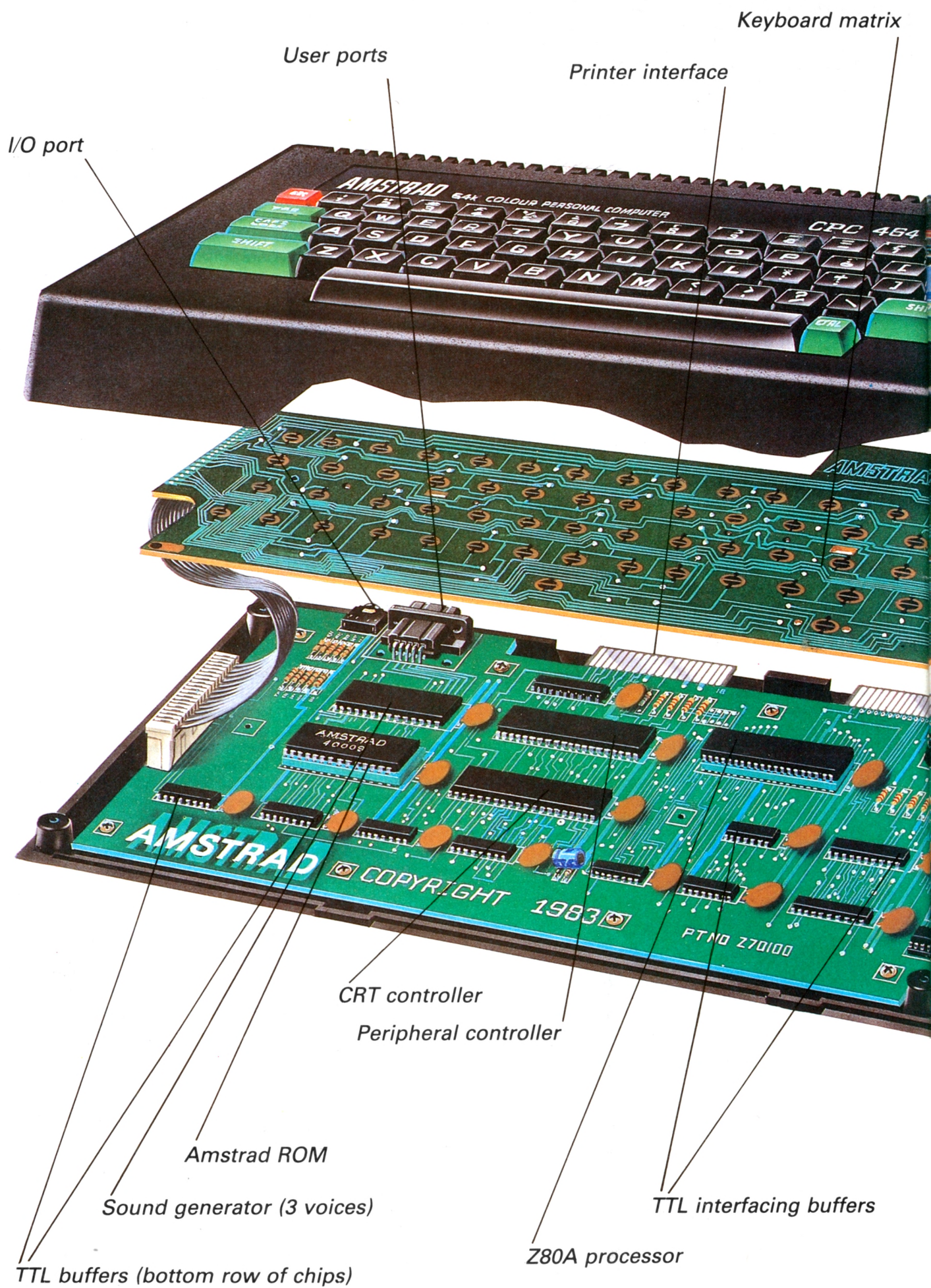
Timer 3 is the most important. Timer 2 and the three sound channel queues have equal priority, and timers 1 and 0 are lower priority, interruptible by just about everything. When executing an interrupt, it's advisable to make sure you can finish your routine by starting with a Disable Interrupts (DI) command, and to enable it again with EI when the routine is over.

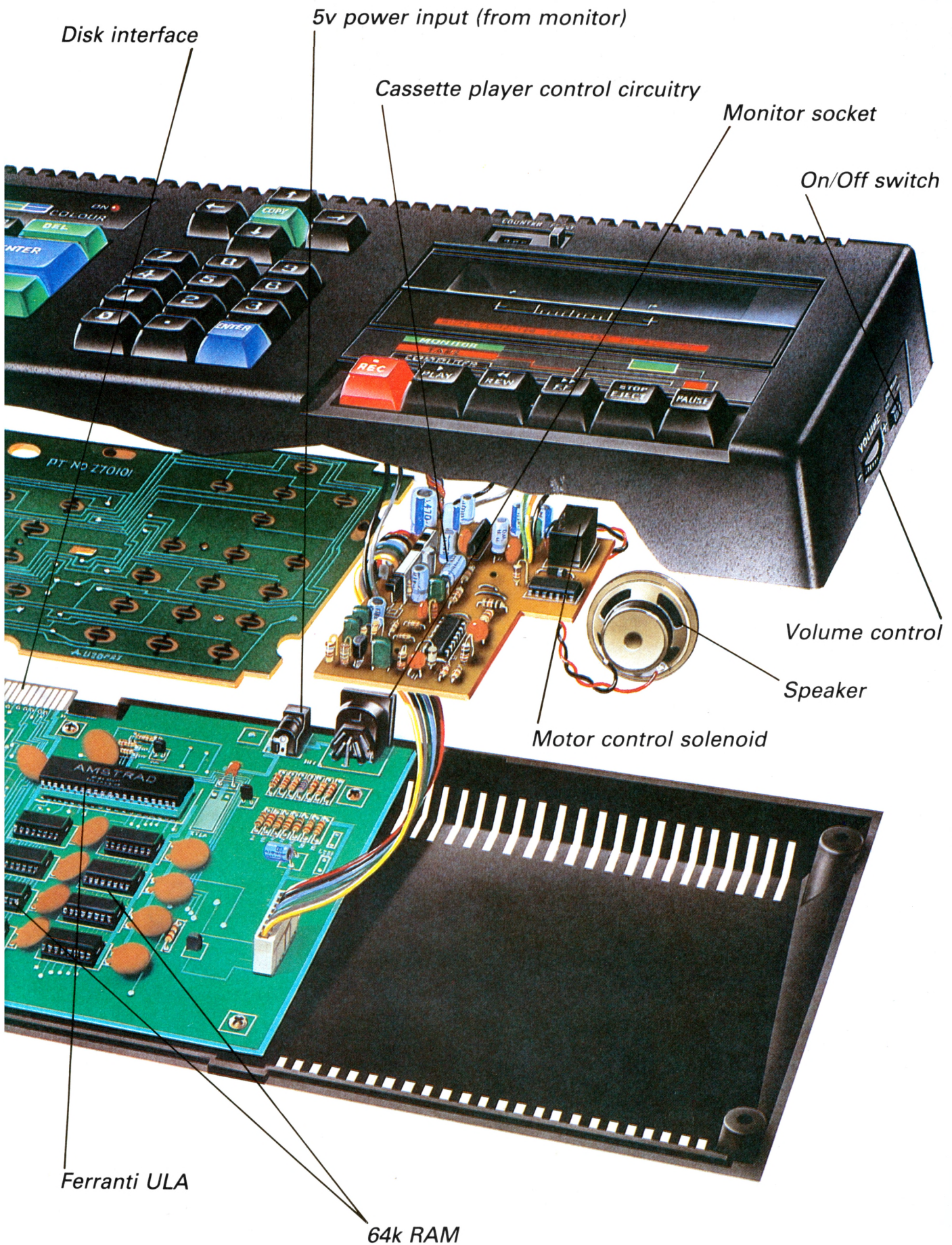
There are other innovations, too. PRINT@ doesn't mark the screen but returns the location in memory of the named variable. I also like the way the keyboard is defined: it can be read directly by key number, or indirectly by interpreting the ASCII code generated. The pattern printed on the screen is derived from information stored in ROM, and can be cleverly defined as being in RAM, too, with the SYMBOL AFTER command. SYMBOL AFTER 32 means that the ROM defines characters up to ASCII 32, and user definitions apply afterwards.

The ASCII stream can also be altered, and there are 128 characters available



Both monitors give a clear and precise display





BENCHTEST

for redefining keys. It's possible to program the control-function of several keys to provide Basic keywords, as on the Spectrum and Commodore machines.

Editor

The firmware includes a powerful editor for the Basic programmer, which is as good an editor as is available on any micro today. It is derived from the Microsoft line number editor but is enhanced so much that its ancestry is quite lost.

A line of Basic, program or direct command can be typed at any point on the screen. Text can then be read into it from another part or parts of the screen, using the 'copy cursor'. It can be edited while you type by using the cursor keys. There is a flaw in this editor, hardly a disastrous one, but one which the user has to be aware of before use. The copy cursor is baffled by background colour different to expectation. Changing background colours is not a trivial matter, and the safe thing to do is to make sure you never change ink, pen or paper while editing a program.

The other editing mode is exactly the same as in Microsoft Basic. Line 25, for example, if it has a syntax error, will be presented to the user in edit mode when run. The line can be edited separately with the command EDIT 25. The editing commands for the line are proper line edit commands, with delete and insert, move to left and right of the line, top and bottom of the numbered line, or complete statement. Debugging is also controlled by Microsoft-like TRON and TROFF trace commands, which print the line number of each line before it's executed. LIST sends the Basic code to stream #0 unless otherwise specified: — for example, LIST #8 will print on the line printer, LIST #2 will send the listing to window #2, and so on.

Execution of a program is paused by one stroke on the ESCAPE key, and resumed by touching any other key. It takes two strokes of the ESCAPE key to cause a **Break**.

Firmware

Locomotive went to a lot of trouble to ensure that software houses could use the Amstrad firmware for machine code programs, as well as Basic. The list of available routines is long, and is published as an optional extra manual (which I'm told will not be cheap).

One section worthy of note is the feature which comes close to the *FX commands of the BBC Micro. This is the control character function. Type control-X and you get a strange graphics symbol. But type PRINT "X" and the effect of the control character will be a system call. System calls produced from software in this way will clear the screen, empty a specified window from the top, beep, and so on.

Applications software

The drawback of any new micro is the lack of software, but Amsoft hopes to have 50 titles at launch.

The software designers at Locomotive believe that the extreme simplicity of the hardware and its close relationship to the Spectrum will enable Spectrum software to be transferred by the authors with minimal patching.

They also believe that within a couple of months software writers will begin to discover things that the published, open firmware makes possible on this machine, and which just aren't possible on older designs.

Documentation

The manuals were the only part of the system which I didn't see in final form. Printer proofs show that the designers and software designers have done a thorough job, and attempted to produce the sort of manual which the average user will find easy to understand.

Prices

Amstrad CPC464

Monochrome display	£200
Colour display	£300

Technical specifications

Processor	Z80
Memory	64k
Keyboard	Qwerty; numeric keypad
Display	80-column; colour and monochrome
Operating Language	Locomotive Basic
Interfaces	RGB monitor socket, power, disk, printer, user and I/O
Sound	Stereo; built-in loudspeaker and volume control
Applications	50 titles at launch date
Expansion	Joystick, TV modulator serial interface and diskette drive

Benchmarks

BM1	1.09
BM2	3.28
BM3	9.16
BM4	9.61
BM5	10.20
BM6	19.03
BM7	30.18
BM8	34.20

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

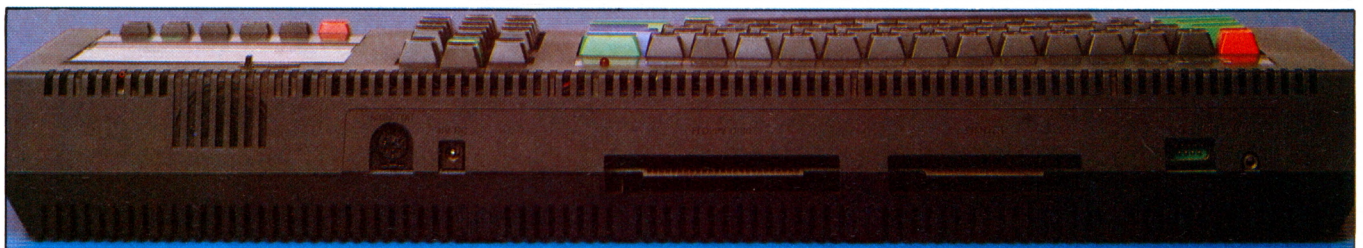
Conclusions

Like Amstrad audio equipment, the new computer is a good, honest functioning machine with several useful features that grander and more expensive machines lack. It represents a significant step forward, coupled with a real marketing breakthrough in the 'unit' approach and the inclusion of a quality display for under £300.

My dislikes were few. It should have an indicator light on SHIFT LOCK and CAPS LOCK; and the serial interface is more important (especially to Micronet and bulletin board users) than Amstrad realises.

The monitor, rather than TV output, is a very good idea; and a machine without a tangle of cables going to tape, power supply and domestic TV is excellent. The Amstrad is a powerful, fast machine, with plenty of memory, easy to program, and packaged in a way that means it will comfortably outsell the Acorn Electron, and give the Commodore 64 and Sinclair Spectrum a hard run for their money. I expect some 200,000 systems to be sold by the end of the year.

END



From left to right: RGB monitor socket, power in, disk interface, printer port, user port and I/O

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WHAT

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WHAT MICRO? TEST

Amstrad CPC 464: £239

Price wars out

Latest in Amstrad's long line of cut-price electrical goods is a great micro. Reviewed by Geoff Bains

Until recently all the home micros on the market have been very much products of computer companies. With the arrival of the Einstein (reviewed last month) and now the micro from Amstrad all that is set to change.

Although, in many ways, it matters little to you who designed and made your micro, such matters have a strong bearing on the market. In the two and a half years since its release, the BBC micro, sold as it is by a once very obscure and small company, has sold about 170,000 micros in this country.

Amstrad is confident that its micro will sell 200,000 of its £240 and £350 micros by next Christmas. Most of these will be retailed in those bastions of cheap and easy electronics, Rumbelows, Currys, Comet, and Boots. Amstrad is basically selling the micro where it can be bought along with the company's hifi and television.

With sales figures like those by Amstrad, a micro just cannot help but make a significant impact. Fortunately the Amstrad CPC 464 is memorable in other ways too. Not least because the Amstrad micro is now in the shops just when Amstrad promised.

Complete package

To tie in with the company's other products, the Amstrad micro is sold as a complete package. This is a phrase that is much bandied around the computer

business, but here it does seem to have been used genuinely. The Amstrad comes complete with a built-in cassette deck for your programs storage and with a monitor - colour or monochrome, depending on the model. All you have to do when you get the thing home is to put a plug on the end of the single mains lead. The Amstrad is the music centre of the micro world.

The built-in cassette deck does have one rather difficult consequence for the shape of the micro. It is enormously long. With a full keyboard, a numeric pad and a cassette deck all stuck one next to the other, the whole micro is nearly two foot long. This is accentuated by the fact that the machine is only about six inches deep. However the exact shape probably will matter less on this micro than others because it is liable to be set up and left alone. As most home micros rely on the family TV



in the open

for their display they tend to spend a lot of their time being unpacked and packed away again to make way for 'Crosroads'. The Amstrad has its own display so it can stay out, in the other corner of the room.

Function keys

Typists with nimble fingers are well catered for with the Amstrad. The keyboard is very good. It has a bit of a rattly feel about it and some would prefer a little more firmness in the keys. Nevertheless a couple of hours continuous typing on this micro does not seem a harrowing thought, for that reason at least. As well as the QWERTY arrangement of typewriter keys there is also a numeric pad and a set of cursor control keys. If you are going to spend a lot of time keying numeric data into your micro, a numeric pad is a godsend. The

wonderful advantage of the pad on the Amstrad is that these keys double as function keys.

Each key on the keyboard produces a code inside the micro that is used to tell which character is meant by the key for putting on the screen, and what action to take when the key is pressed. That much is the same on any micro. However, on the Amstrad the number keys in the numeric pad produce different codes than those on the top line of the bulk of the keyboard. This, coupled with the fact that you can redefine the interpretation the micro gives to any of these codes, means that you can set up the numeric keypad to act as, say, single key function keys to run, list and load programs, while the normal number keys remain number keys. In fact the numeric pad along with the shift and control key can produce thirty-two different functions. It is, in all, a much more versatile

system than the normal programmable function keys that you find on the BBC micro and the like.

The only problem is that the keys' origin as a numeric pad forbids you to actually label them – there just isn't the room around all the keys. When the micro is switched on, the numeric pad acts as a normal numeric pad with the exception of the 'enter' key included in it. This, when pressed with the control key, will load and run any game or the like, sitting in the cassette deck.

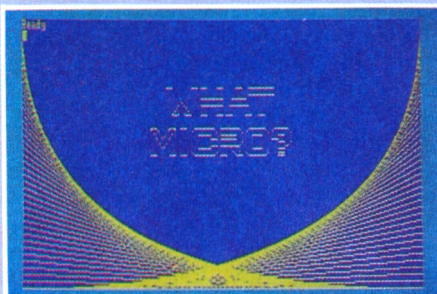
The cassette recorder built-in to the Amstrad is a point of contention. The mechanism is one of Amstrad's standard cheap cassette player mechanisms. That's okay. However, as there is no way to use the Amstrad micro with any other cassette recorder, things are going to prove tricky if the cassette breaks down. You have to be prepared for this to happen. Having said that it must be said that the cassette recorder mechanism gave no trouble during the review. However the first micro refused to load programs at all and a replacement was needed. Anyway, a cassette recorder dedicated to a micro has a pretty easy life. Playing or recording for about five minutes every time the machine is used. Even the cheapest mechanism will last a while at that rate.

Programs are saved at either 1000 or 2000 baud. That's pretty fast. When loading a program, the micro automatically detects which speed the program was saved at and adjusts itself accordingly. Very neat.

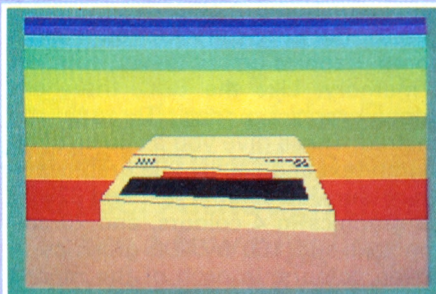
Rear sockets

Having a built-in cassette recorder has allowed Amstrad to take the most sensible course with the control of the recorder's motor. Fast forward and rewind are there to use at all times. Play and Record are operable only when the micro wants to load or save a program or data. This is just about the most sensible arrangement, short of a recorder totally under the control of the micro.

Around the back of the machine there is a dazzling array of sockets for a machine of this price. There is a socket labelled 'user port' that is actually nothing more than a joystick port. Amstrad is selling its own joysticks to go with the micro. These are similar to the standard Atari/Commodore type but feature the peculiar arrangement of chaining together. The first stick plugs into the micro and the second into the first. A normal standard joystick can be used as the first stick. The second stick has a direct equivalent in certain of the keys on the keyboard. These can be used instead of a second joystick.



The Amstrad shows the BBC who's boss



COMPARABLE MICROS

Model	Price	Memory	Free memory for basic	Joystick interface	Printer interface	Approx price with cassette recorder and colour monitor
Amstrad CPC 464	£239	64K	42K	✓	Centronics	£349
Atari 600XL	£160	16K	6½-13½K	✓	Own	£410
BBC	£399	32K	9-28K	✓	Centronics & RS 232	£615
Commodore 64	£190	64K	38K	✓	Own	£440
Memotech MTX 500	£275	80K	62K	—	Centronics	£490
Spectravideo 318	£186	80K	46½K	✓	—	£400
Spectrum 48K	£130	48K	39K	—	—	£400

WHAT MICRO? TEST

Amstrad CPC 464: £239

Next to the joystick port there is a printer port. This is a Centronics type output. It's a pity that a real socket couldn't have been used here. The type of edge connector that is used is liable to wear easily after a few pluggings and unpluggings of the printer lead. Amstrad is selling a printer in its own colours to connect on here but any Centronics printer will do the job.

Another edge connector resides next to the printer port. This is the general purpose expansion socket. General purpose is hardly a sufficient name for it. Everything that you could possibly need to interface any kind of add-on to the Amstrad micro is available at this socket. There are even lines to cater for external sound generators and light pens. The main add-on to fit here, however, is the disk drive upgrade. This will be available later this year. It will not only give you the advantages of disk drives, but also more memory and the CP/M operating system. A complete CP/M business machine will then cost you in the region of £500, which is cheap by any standards.

One of the other types of add-on that will soon appear makes use of the Amstrad's ability to take 'sideways' Roms. Like the BBC micro the Amstrad can take a variety of different language Roms or even Roms that just add to the existing facilities of the machine. These Roms take up no more memory space in the micro. Such add-on Roms have proved to be one of the most useful facilities of the BBC. Their addition in the Amstrad is a very welcome one.

There are also sockets on the Amstrad for sound output (in stereo, no less) to go to a hifi amplifier and one for the monitor.

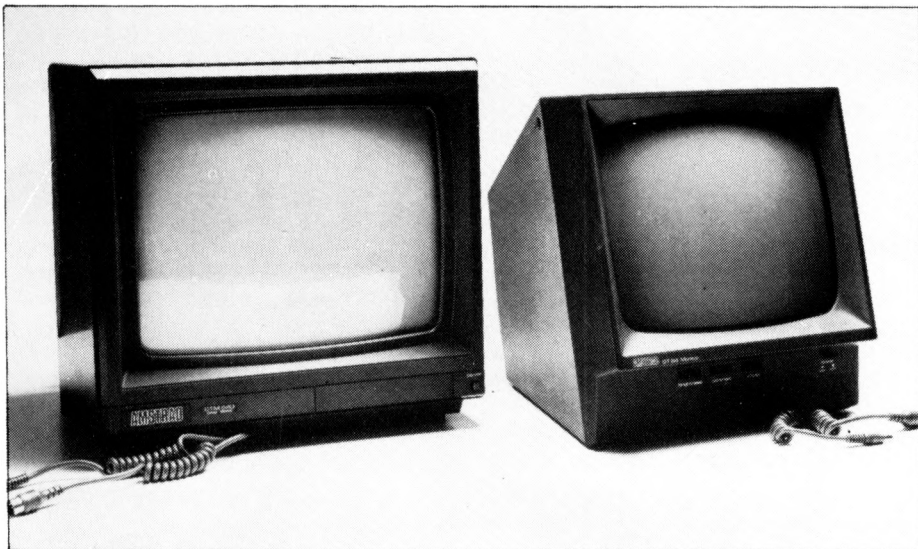
Different monitors

There are two models of the CPC 464 available. Both use the same micro but different monitors. For £230 you get a monochrome monitor included. This is quite good enough quality for just about anything the micro will do. It shows 80 column text easily and the graphics look crisp and clear, but of course everything is only in black and green. The alternative is the £330 colour version. The colour monitor is only a medium resolution one. Reading 80 column text on this is not easy but graphics are shown to their full in marvellous technicolour.

The problems arise when you consider that the power supply for the micro is contained in the monitor that you buy with it. Once you have bought a monochrome version that you buy with it. Once you have bought a monochrome version you can upgrade it with a colour monitor from an independent supplier, but you still have to use the mono monitor for its power supply because Amstrad is not supplying the colour monitors with a power supply on their own. Amstrad's way around this problem is to sell a modulator/power supply for £30 that

DISPLAY

Model	Max no of Colours	Choice of Colours	Max. Graphic Resolution	Max. Test Format	Sprites	Range of Control	Ease of Use	Overall
Amstrad CPC 464	16	27	640x200	80x25	—	7	8	8
Atari 600XL	16	256	320x192	40x24	6	7	6	8
BBC	8	8	640x256	80x32	—	8	6	9
Commodore 64	16	16	320x200	40x25	4	4	2	4
Memotech MTX 500	15	15	256x192	40x24	32	8	6	7
Spectravideo 318	15	15	256x192	40x40	32	8	7	8
Spectrum 48K	8	8	256x176	40x24	—	6	8	6



will enable you to forget the monitors and use your micro with a TV.

This whole system is rather unsatisfactory. Sooner or later, however, an enterprising company is bound to start selling power supplies of their own, so that you can use the micro with whatever monitor you choose.

A monitor is important with the Amstrad micro because of the high resolution graphics possible with this machine. The graphics potential of the Amstrad is basically better than that of the BBC, the previous king of the graphics on home micros.

Unlike the BBC, the Amstrad micro's superb graphics do not leave you short of memory. Like the BBC, there are various graphic 'modes': Three on the Amstrad. These give you a choice of 80 column text and 640 by 200 graphics in two colours, 40 column text and 320 by 200 graphics in 4 colours, and 20 column text and 160 by 200 graphics in sixteen colours. In each of the modes the colours available on the screen can be chosen from a palette of 27 colours.

In addition, the colour can be made to flash at any rate you care to choose.

Stereo sound

Sound, too, is catered for extensively on the Amstrad. There are the usual three note channels. Each of these can also have white noise with the note. There are an amplifier and loudspeaker built-in to the machine which function as well as such a system can be expected to. You get a volume control too. However, to really blast your ears off you can always connect the micro to an amplifier.

Connected like this, you can produce sound in stereo. As the spacecraft drifts across the screen so the bleeping and any other noises it makes can move from speaker to speaker. Some of the games that are already available for the Amstrad make good use of this and the effect (with the hifi turned up to suitably deafen the neighbours) is quite amazing.

As if stereo sound wasn't enough there is also excellent control over the

BASIC

Model	Range of Commands	Ease of Use	Line Re-Number	Line Auto-Number	Trace	Full Error Messages	Error Trap	Basic Maths Time	Basic Sort Time	Basic Text Time	Basic Graphic Time
Amstrad CPC 464	8	8	✓	✓	✓	✓	✓	46	16	113	99
Atari 600XL	6	6	—	—	—	—	✓	355	34	103	179
BBC	8	8	✓	✓	✓	✓	✓	55	11	29	25
Commodore 64	4	5	✓	✓	—	✓	✓	88	24	65	N/A
Memotech MTX 500	6	5	—	✓	—	—	—	81	26	84	67
Spectravideo 318	8	8	✓	✓	✓	✓	✓	347	23	94	94
Spectrum 48K	5	8	—	—	—	—	—	176	36	151	57

WHAT MICRO? TEST

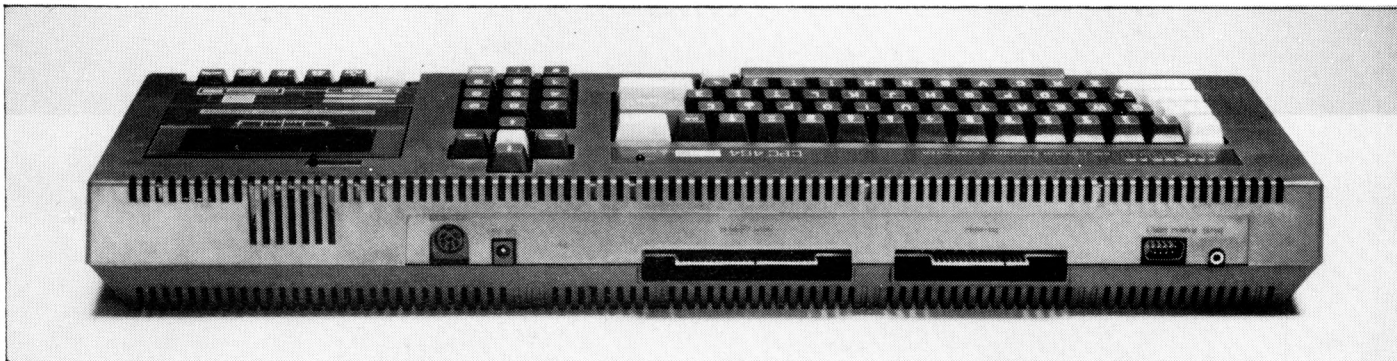
Amstrad CPC 464: £239

KEYBOARD

Model	No. of keys	No. of func. keys	Numeric Pad	Feel	Layout	Overall
Amstrad CPC 464	74	12	✓	8	7	8
Atari 600XL	61	5	—	8	7	7
BBC	74	10	—	9	7	8
Commodore 64	66	4	—	8	8	7
Memotech MTX 500	79	8	✓	7	7	7
Spectravideo 318	71	5	—	7	7	7

SOUND

Model	No. of Voices	Range of Control	Ease of Use	Loudness	Audio Line Output	Overall
Amstrad CPC 464	3+noise	9	8	6	✓	9
Atari 600XL	3+noise	7	7	TV	✓	7
BBC	3+noise	9	4	4	—	8
Commodore 64	3+noise	6	2	TV	✓	7
Memotech MTX 500	3+noise	7	7	TV	✓	7
Spectravideo 318	1	3	8	2	—	3



sound itself. The Amstrad offers control from Basic over the envelope, or shape, of the sound. Both volume and pitch envelopes can be set. The system is at least as powerful as that on the BBC and considerably easier to use. Full marks to Amstrad for this one.

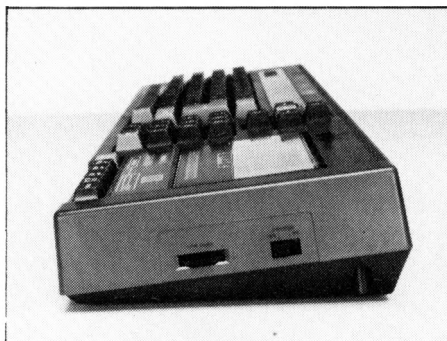
The whole of the Basic can be summed up quite well as 'easy to use'. A lot of thought has gone into this Basic. Although there are a few niggling omissions, the overall effect is brilliant.

Interrupt commands

The Basic to control the graphics is a bit disappointing. True, the screen handling is quite fast, and, most of the facilities provided are superb – windows, redefinable characters, easy use of colour – but there is one important omission. There is no method of filling in an area of the screen with colour. Most micros have a command to draw blocks of colour on the screen. These can be used to build up shapes. Many of the newer micros have commands that will fill in an area of the screen that is enclosed with a shape's outline. The Amstrad has neither of these facilities. The only way to draw a solid shape is by drawing lots of single lines very close together. The Spectrum, too, suffers from this omission, but that doesn't seem to have quelled enthusiasm for that machine.

The good news is that in the very near future a suitable Rom will probably appear on the market to provide the necessary commands to draw solid blocks. It's just a pity that the otherwise well thought out Amstrad lacks this at the moment.

One excellent feature of the Basic that is miles ahead of any other version of the language is the treatment of interrupts on the Amstrad. On the Amstrad you can write a small subroutine to, say, move an alien character on the screen.



Then the Amstrad can be set up to stop whatever it is doing and call this subroutine, and so move the character, perhaps every half a second, then return to where it left off. All this from Basic. You can do similar things on other micros, but by delving into the depths of machine code. On the Amstrad it is all there on the surface ready to use.

‘The whole of the Basic can be summed up as easy to use. Although there are a few niggling omissions the overall effect is brilliant’

Actually writing programs on the Amstrad is easy too. A very reasonable program editor is included in the Basic. In fact you really get two. You can either edit a program using the copy cursor editor, very similar to the one on the

BBC, or else, if you prefer, there is an old fashioned line editor available. When the micro meets a mistake in a program it will present you with the incorrect line on the screen ready for editing with the line editor. Program writing is also helped by a good selection of line renumbering, deleting commands, and the like.

Good value

The worst let down of the whole micro is the manual. This is not wonderful. It is written in plain English but it makes little attempt to really teach the joys of owning an Amstrad, and of joys there are plenty. A good number of books should appear to remedy the situation.

You can of course buy the Basic Reference manual, but this makes no attempt to teach either. It just gives more details on the Basic commands. For the really keen there is a technical reference manual as well. This tells you all you need to know to write machine code programs and to build add-ons for the machine.

It is recommended that you take several degrees in electronics and computer science before you attempt that one. The extra manuals will cost you about £20 each.

Despite the few niggling grudges, Amstrad has done well with the CPC 464. There was a time when any self-respecting hifi snob wouldn't be seen dead in a shop selling Amstrad equipment.

Now he can always pretend to be just looking at one of the best home micros on the market, and certainly the best value for money. ■

VERDICT

The Amstrad CPC 464, at £239, certainly is a micro for the people. Though this would be a limitation to most manufacturers, Amstrad has produced a micro that is not only cheap but excellent as well. Even without the monitor and cassette recorder, it would be a bargain. With them there is little to touch it.

AMSOF T's Soft Centre...

A computer as comprehensive and attractive as the CPC464 will inevitably attract a wide range of software: educational, entertainment, utility, business, 'custom' applications of all types.

Amsoft has been established to encourage and harness this effort to provide software for CPC464 users.



Watch out for AMSOFT software centres at retailers - or buy from AMSOFT direct. The autumn catalogue is available now to help you choose, although you should also watch the press for details of the new software being launched each week.